LAWRENCE BERKELEY LABORATORY

COMPREHENSIVE FACILITIES PLAN
(DRAFT)

Ernest Orlando Lawrence Berkeley National Laboratory
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PREFACE

The Ernest Orlando Lawrence Berkeley National Laboratory 1996 Comprehensive Facilities Plan (CFP) is a comprehensive summary of information developed through site planning and the Capital Asset Management Process (CAMP). In conjunction with the Site Development Plan (SDP), the CFP is a guide for effective use of the Laboratory's land and facilities resources. The CFP and SDP provide a conceptual and operational framework for the rehabilitation of existing facilities and the development and siting of future buildings. It is intended for use by the management and staff of the Laboratory, the Department of Energy, the University of California, and the neighboring communities.

This CFP is based on previous planning documents and current studies and analyses. Revisions are based on the Laboratory's annual Institutional Plan, SDP, and recent planning reviews and analyses. The document describes the physical setting, facilities and asset planning processes and underlying planning concepts, trends in Laboratory activity, facilities requirements, and future site development.

The CFP has been developed as part of a continuing planning and review process involving the Laboratory's 14 scientific and support divisions. The final preparation of the document was coordinated through the Facilities Department, with institutional elements prepared by the Office for Planning and Development.

DIRECTOR'S FOREWORD

Charles V. Shank
Berkeley Lab Director

Ernest Orlando Lawrence Berkeley National Laboratory's (Berkeley Lab) mission as a multiprogram national laboratory is to perform leading research in the energy, general, and life sciences, to develop and operate unique national experimental facilities, to train the next generation of scientists, and to enhance industrial innovation. The CFPD supports the Laboratory's Site Development Plan and addresses the major issues and the opportunities for site improvement that are critical to the continued fulfillment of this mission, under conditions that protect our staff, the public, and the environment. The Laboratory strongly supports these strategic planning activities as part of a national effort to restore and maintain the nation's scientific infrastructure. These planning activities are an integral part of the Berkeley Lab strategic planning process, the objective of which is to realize Berkeley Lab's vision of a laboratory that works effectively and efficiently.

The Laboratory occupies 81 permanent buildings on the main site and space in 19 buildings at the University of California, Berkeley (Main Campus and Richmond Field Station). This is a significant change since 1931, when the Laboratory consisted of a single campus building. During the past year Berkeley Lab conducted more than 800 research programs and projects involving 3,600 staff and over 1,500 guests.

During the past several years the Laboratory's continuing evolution to a multiprogram laboratory has resulted in the completion of the Advanced Light Source, new building construction, and major improvements to utilities. The current CFPD provides a strong framework for safe and environmentally sound future development. Implementation of the CFPD will require continuing effort and support by the U.S. Department of Energy, the University, and the Laboratory community.

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EXECUTIVE SUMMARY

PURPOSE

The Ernest Orlando Lawrence Berkeley National Laboratory 1994 Comprehensive Facilities Plan (CFP) document provides analysis and policy guidance for the effective use and orderly future development of land and capital assets at the Berkeley Lab site. The CFP directly supports Berkeley Lab's role as a multiprogram national laboratory operated by the University of California (UC) for the Department of Energy (DOE). The CFP is revised annually. Major revisions are consistent with DOE policy and review guidance. The specific purposes of the CFP are to:

- Summarize the physical and community setting of the Laboratory.
- Describe the existing Laboratory organization, programs, site, and facilities.
- Analyze programmatic trends and their facilities and asset requirements, shortfalls, and redevelopment needs.
- Provide policy guidance and 20-year and 10-year plans to support effective use and orderly growth, development, and life cycle maintenance of the Berkeley Lab site.
- Describe the Laboratory's facilities and asset planning approach and methodology.
- Discuss asset based databases and analyses.

The CFP concisely expresses the policies for future development based on planning concepts, the anticipated needs of research programs, and site potential and constraints. This Executive Summary highlights management issues and outlines major sections of the document.

PLANNING OBJECTIVES AND GOALS

Site planning at the Laboratory reflects long-range institutional goals and values consistent with the University's management of Berkeley Lab to support DOE missions. Planning objectives are as follows.

- Evaluate future mission projections and anticipate DOE national research facility needs.
- Insure a safe and healthful workplace in full compliance with building and fire codes.
- Protect the environment and buffer activities to enhance adjacent land uses.
- Protect the national investment in valuable government-owned research and support assets.
- Consolidate research and support services through proper siting of new buildings and maintenance of functional units.
- Work with UC to identify projects with synergistic benefits.
- Make efficient use of unique Laboratory assets and the adaptive reuse of facilities with potential to support Laboratory missions.
- Improve access and communications within and to the Laboratory.
- Promote cost reductions and energy conservation through efficiencies in building design and location, operations and maintenance, and parking and transportation.

MANAGEMENT ISSUES

Berkeley Lab's site-planning management issues focus on developing the strategic framework for structures and utilities necessary to achieve the Laboratory's mission safely and protect the environment. These issues include improving the reliability of utility systems, ensuring a safe working environment, restoring and rehabilitating obsolete buildings, consolidating support functions, and accommodating the increasing numbers of scientific guests and visitors using Berkeley Lab's national research facilities. Many Berkeley Lab site-development issues stem from an obsolete, deteriorated infrastructure constructed during World War II and the immediate postwar period. During the past several years, DOE has begun significant investments to correct deficiencies in mechanical and electrical utility systems and programmatic facilities for materials research. The near-term (10 years) and long-term (20 years) facilities issues being addressed by Berkeley Lab and DOE include**:**

- Building Replacement and Rehabilitation
- *Mechanical Utility Upgrades*
- *Electrical Utility Upgrades*
- Environment and Safety Improvements
- *Consolidation of Support Services*
- *Consolidation of Facilities Support*
- *Bevalac Accelerator Decommissioning*

COMMUNITY SETTING

The 54-hectare (134-acre) Laboratory site, located within 478 hectares (1180 acres) of University of California land, is leased by DOE through a series of 50-year lease agreements (Appendix D). The Laboratory is in Alameda County (population 1,280,000), with the eastern section in the City of Oakland (370,000) and the western section in the City of Berkeley (103,000). Berkeley Lab works with these cities on matters of mutual concern, including fire protection and traffic management. Although the area is largely urban and is served by interstate highways and an extensive public transit system, the Laboratory site has a hilly topography and a backdrop of eucalyptus plantations and parks that give a rural character.

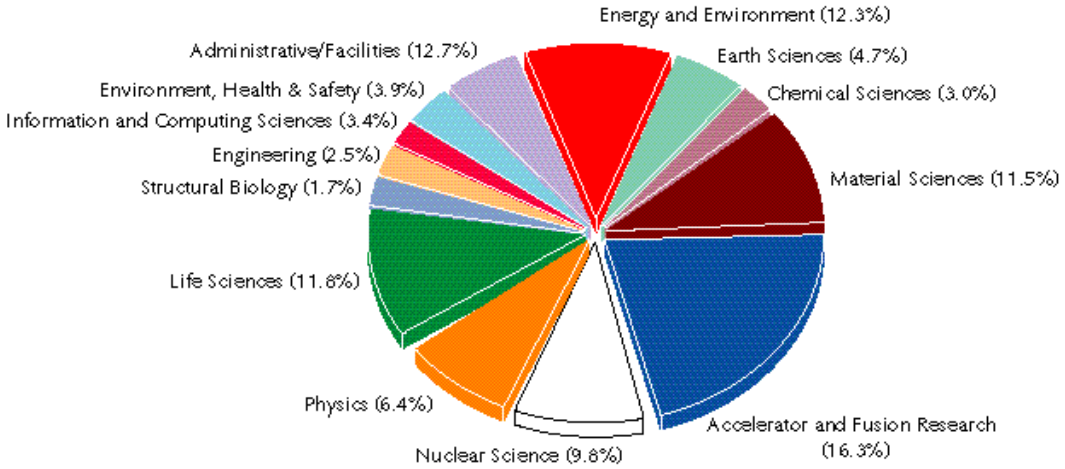
- *Land Use and Topography*. The Laboratory is on a hillside with elevations between 150 and 300 meters (500 and 1000 ft). The Laboratory site is zoned governmental and institutional by the cities of Berkeley and Oakland. On all sides of the Laboratory is a buffer zone of University land. In addition, the CFP provides for landscape buffer zones between Berkeley Lab facilities and the Laboratory boundary and includes guidelines to ensure compatibility with land use outside the University buffer zone.
- *Transportation Systems*. The Laboratory and the cities of Oakland and Berkeley are served by a network of public transit systems, three international airports (San Francisco, Oakland, and San Jose), two railroads, the Bay Area Rapid Transit (BART) system, and a network of interstate freeways and state highways. In addition, Berkeley Lab operates shuttle buses around the site and between the Laboratory and the UC Berkeley campus and downtown Berkeley.
- *Public Utilities and Community Services*. Electricity and natural gas are supplied to the Lab via Pacific Gas and Electric Company (PG&E) transmission lines. Berkeley Lab purchases most of its electricity from the Western Area Power Administration (WAPA). Gas is purchased from the Defense Fuel Supply Center (DFSC). Adequate capacity is expected for the foreseeable future. Water is supplied by the East Bay Municipal Utilities District (EBMUD). The Laboratory implements a program of water-use reduction during periods of drought. Reservoirs adjacent to Berkeley Lab provide water for anticipated emergency needs. EBMUD is currently expanding its supplies and storage capacity to avoid future reductions in service. The Laboratory provides its own fire protection service, which cooperates with the City of Berkeley Fire Department under a mutual aid agreement. Several hospitals are nearby.
- *Community Involvement*. Berkeley Lab efforts to enhance compatibility

and to coordinate activities with the surrounding communities include three principal programs: (1) a Hill Area Fire Safety Program with the University and Berkeley fire departments, (2) an Berkeley Lab Traffic and Parking Management Plan to discourage single-occupant vehicles and to encourage other transportation options, and (3) a plan to ensure that historic buildings are preserved.

LABORATORY MISSION

The Laboratory, established in 1931 by Ernest O. Lawrence as a single-purpose accelerator-based University research facility, has evolved into a multiprogram national laboratory with a mission to:

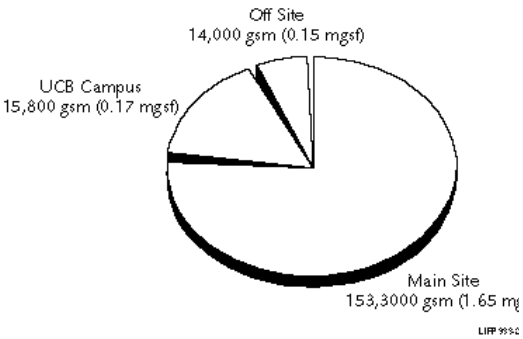
- Perform leading multidisciplinary research in the energy sciences, general sciences, and biosciences in a manner that ensures employee and public safety and the protection of the environment. The energy sciences include materials research, chemistry, earth science, and energy and environmental research. The general sciences include nuclear and high-energy physics and accelerator research. The biosciences include the life sciences and structural biology research.
- Develop and operate unique national experimental facilities for use by qualified investigators from throughout the world, including the Advanced Light Source, the National Center for Electron Microscopy, the 88-Inch Cyclotron, and the National Tritium Labeling Facility.
- Educate and train future generations of scientists and engineers to promote national science and educational goals. 440 graduate students pursue research at Berkeley Lab with about 100 students receiving advanced degrees each year. Precollege programs are conducted for science educators and students.
- Transfer knowledge and technological innovations, and foster productive relationships between Berkeley Lab research programs, universities, and industry to promote national economic competitiveness. The Center for Advanced Materials, the Center for X-Ray Optics, and the California Institute for Energy Efficiency are examples of collaborations with industry. Technology transfer programs promote the application of research results.



Projected costs for FY 1994, $275M

LABORATORY CONDITIONS

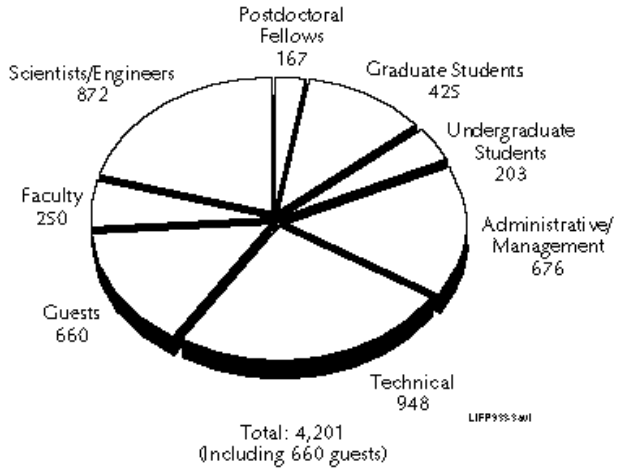
- *Research and Technical Programs*. Berkeley Lab programs are primarily supported by the DOE Office of Energy Research (OER) (54%). The largest programs are in Basic Energy Sciences, Nuclear Physics, High Energy Physics, and Health and Environmental Research. Energy Efficiency and Renewable Energy (9%) supports studies in building energy conservation, energy storage, and solar and geothermal energy. Other DOE-sponsored programs (16%) include environmental restoration and waste management, radioactive waste disposal, and fossil energy. Work for other agencies and institutions (21%) is primarily for the National Institutes of Health (NIH), Department of Defense (DOD), states, and private industry.



- *Condition of Buildings and Other Improvements*. Berkeley Lab research and support activities are conducted in structures totaling 180,000 gsm (1.97 Mgsf), including 153,000 gsm (1.65 Mgsf) on the main site, 16,000 gsm (0.17 Mgsf) on the UC Berkeley Campus, and 14,000 gsm (0.15 Mgsf) leased off site. In FY 1994 the average age of the main-site buildings is 35 years. The inventory of main-site building space, including current construction, is
  - Adequate: 50,600 gsm (544,500 gsf)
  - Substandard, can be made adequate: 82,500 gsm (887,800 gsf)
  - Substandard, cannot be made adequate: 20,100 gsm (216,700 gsf)
- *Utilities*. Berkeley Lab's utilities distribution systems (mechanical, electrical, and communications) are all underground. Many portions were initially sized to serve large accelerators and can meet present and future requirements. However, aged segments require rehabilitation to improve flexibility and reliability. Utility systems undergoing rehabilitation include natural gas, domestic water, cooling water, electrical power, sanitary sewer, compressed air, storm drainage, standby electricity, and alarm and security.
- *Circulation and Traffic*. Berkeley Lab traffic circulates along an east-west central serpentine road, with north and south loops. Gates to the Laboratory are located at the ends of the central east-west road. These main roads were designed in the 1940s and early 1950s and no longer meet construction or safety standards. Nearly 7,000 vehicle trips per day are made to Berkeley Lab, including 70 shuttle-bus trips off site and 98 on site. The off-site shuttle carries an average of about 1,400 passengers per day. Parking space is provided for 1,800 employee vehicles, with 1.8 employees per parking space.
- *Fire, Safety, and Emergency Preparedness*. Berkeley Lab maintains fire protection and emergency preparedness facilities. The University Police Services maintain 24-hour security on site with guard stations at the Laboratory gates, patrol vehicles, and a central dispatch and communication facility on campus. The Berkeley Lab Fire Department provides fire-protection and ambulance services and monitors the fire alarm and sprinkler systems. Berkeley Lab has a Master Emergency Preparedness Plan and specific building emergency plans for dealing with disasters such as fires or earthquakes.
- *Planning Concepts*. The Berkeley Lab SDP and CFP are based on five Berkeley Lab site-plan concepts. These concepts accommodate the facilities improvement

needs within existing geophysical, environmental, and operational conditions. They provide a basis for understanding and evaluating the more detailed elements of the 20-Year and 10-Year Plans. The site-planning concepts are

- Consolidate activities within seven functional planning areas to enhance efficiency and effectiveness and to provide specialized research facilities.
- Redevelop obsolete buildings and deteriorated infrastructure, eliminate temporary structures used for permanent functions, and improve building arrangements to increase safety and energy efficiency.
- Concentrate development along the east-west circulation and utilities axis to enhance transportation and service systems, e.g., develop off-road parking and improve pedestrian pathways.
- Improve and maintain perimeter and internal buffer zones to screen noise-generating activities and minimize potential incompatibility between adjacent operations.
- Provide off-site facilities for receiving, warehousing, and other support and research activities suitable for decentralization.



Laboratory Population in 1994.

- *Design Guidelines*. Design guidelines in the CFP have been developed to achieve specific improvements while respecting site constraints and providing coherence between buildings and their surroundings. These guidelines address the following areas:
  - Safety considerations
  - Utilities corridors
  - Building mass, orientation, and exteriors
  - Energy and operational efficiency
  - Building use flexibility
  - Circulation and parking
  - Topography and grading
  - Landscaping and open space
  - Guideline conformance review

PLANNING ANALYSIS

Research and Support Trends. Berkeley Lab's research and support trends are assessed and described in the FY 1994–1999 Institutional Plan, published in October 1993. Over the next five years the Laboratory does not anticipate major growth, except that associated with the Advanced Light Source (ALS), the Human Genome Center, and further development associated with the Center for Advanced Materials (CAM).

Laboratory Population. In 1993, the Laboratory's employee population consisted of 3,595 full- and part-time employees. These

employees included 855 staff scientists, 250 faculty scientists, 1,005 technical staff, 140 postdoctoral fellows, 710 administrative/management, 435 graduate students, and approximately 200 undergraduates. Berkeley Lab maintains a register of official guests, updated monthly, which contained 1,533 registered guests at the end of 1993. About 600 of these guests were on site at any one time, so that total Laboratory population was close to 4,200. Of this total, about 3,500 are located at the main site, 500 located in UC Berkeley Campus buildings, and 130 located in off-site leased buildings. The 20-Year Plan would allow additional growth up to a total Laboratory average daily population of 4,750, including 640 on the UCB Campus.

Building Needs. Near-term construction needs in support of scientific programs include the following projects:

- Human Genome Laboratory
- ALS Life Sciences Center
- Chemical Dynamics Research Laboratory
- Electron Beam Microcharacterization Facility
- Elise
- ALS Beamlines Initiative

Longer-term building needs include an Energy and Environment Laboratory and other new buildings and additions in many programs, including accelerator research, cell and molecular biology, and heavy-ion fusion. General-purpose facility needs include new buildings for safety, materials handling, and mechanical and electrical engineering. General-purpose facilities, including the Safety and Support Service Facility, Environmental Monitoring and Industrial Hygiene Building, and Facilities Building, would replace existing but obsolete structures.

Utility Needs. Utilities and roadways require improvements to meet current standards for safety and efficiency. The 12 kV electrical system renovation needs to be completed to limit power failures, reduce unplanned outages, improve maintenance, and permit selection of economical electricity sources.

MASTER **20-Y**EAR **P**LAN

Land Use. 32 hectares (80 acres) of the site are currently in undeveloped open space. Much of the open space consists of nine sensitivity zones where development is limited or restricted for a variety of reasons. If all projects identified in the 20-Year Plan were completed 31 hectares (78 acres) would be retained as open space and buffer. The proportion of the Berkeley Lab main site improved with structures, utilities, or roads would change from the current 38% to 42%. Nine buffer zones are described in the CFP, with specific planning criteria identified.

Functional Areas. The functional planning areas are groupings of related facilities that enhance work efficiency and effectiveness. In concept, building clusters form the core of each functional area, with circulation access, service, and parking at the perimeter. The 20-Year Plan identifies changes to each of the functional planning areas to accommodate potential research activities and to conform to SDP and CFP objectives, planning concepts, and design guidelines. The SDP and CFP call for the removal of 20,000 gsm (0.2 Mgsf) of buildings and the renovation of 70,000 gsm (0.8 Mgsf) of building space. Building sites are planned or reserved for 60,000 gsm (0.6 Mgsf) of new construction.

Development Potential. If all the sites and buildings were developed in accordance with the 20-Year Plan, it would result in a net increase of approximately 40,000 gsm (0.4 Mgsf) to the existing main site of the Laboratory, for a total of approximately 190,000 gsm (2.0 Mgsf). For comparison, the 1993 total, including current construction, consisted of 150,000 gsm (1.62 Mgsf) at the main site. The 20-Year Plan increases provide for growth in life sciences, chemistry and materials sciences, conservation and renewable energy, earth sciences, and fossil-energy research. Many of these research areas were not a part of the Laboratory's mission during its period of growth during the 1950s and 1960s under the sponsorship of the Atomic Energy Commission. As indicated in the Planning Analysis section, increases are primarily for programmatic purposes. Proposed general-purpose facilities replace existing obsolete facilities.

TEN-YEAR PLAN

The facilities issues being addressed by Berkeley Lab and DOE during the ten-year construction planning period include:

- *Programmatic Facilities*. Programmatic facilities primarily provide capability for the nation. These facilities projects include the Human Genome Laboratory, Chemical Dynamics Research Laboratory, and Electron Beam Microcharacterization Laboratory. The completion of existing space and additions are proposed for the ALS instrumentation and user facilities. Other programmatic projects include modifications for heavy-ion accelerator research (Elise), cell and molecular biology, biomedical isotope facilities, and magnetic fusion energy ion source test stands. Each programmatic facility, like general-purpose facilities, integrates the National Environmental Policy Act; the California Environmental Quality Act; and environment, safety, and health considerations into design and project review from the early conceptual phases through completion of construction and operation.
- *Accelerator Improvement Projects.* ALS will install new equipment systems for enhanced overall performance of the accelerator storage ring and beamline development. These additions will enhance experimental equipment and beamline components, provide photon beam stabilization, and include accelerator system upgrades to improve performance. The installation of the Electron Cyclotron Resonance (ECR) source at the 88-Inch Cyclotron has resulted in greater than fivefold increase in beam intensity. Design efforts for the next-generation, gyrotron-driven ECR source are under way.
- *Environmental Restoration and Waste Management* (ERWM). Berkeley Lab environmental management projects are essential to correct and restore environmental conditions and improve waste handling. The ERWM Five Year Plan addresses waste management, environmental restoration, and corrective actions. Waste management and environmental restoration are continuing programs to provide safe waste management operations, timely cleanup of soil and ground water contaminated by past Berkeley Lab operations, and enforcement of strict management controls to minimize possible environmental damage from future operations. Berkeley Lab's waste management operations include waste pickup and transport to the onsite HWHF and repackaging and storage of hazardous, mixed, and low-level radioactive wastes being shipped to approved offsite treatment, storage, and disposal facilities.
- The Site Restoration Program, initiated in FY 1991, addresses all soils and ground water contamination from past Berkeley Lab operations. Currently in the assessment phase, this program will investigate contaminated areas, examine remedial alternatives, and restore the site according to standards of cleanliness to be negotiated with the State of California.
- The environmental restoration program for facilities covers assessment and remediation of chemical contamination, closure of the existing hazardous waste handling facility and planned decontamination and decommissioning activities for the Bevalac.
- *Environment, Safety and Health Management Plan for FY 1996-FY 2000*. The Laboratory has prepared a detailed environment, safety and health (ES&H) 5-year plan. The prioritized plan strengthens DOE ES&H management and improves the allocation of ES&H resources. Key projects for health, safety and environmental compliance are included.
- *Decommissioning Plan.* Berkeley Lab's Bevalac accelerators were shut down in February 1993. Associated costs for preparation and decommissioning of

the accelerators are being identified and reviewed with ERWM.

- *Multiprogram Energy Laboratory Facility Support* (MEL-FS). The total proposed ten-year (FY 1996-FY 2005) MEL-FS program will require budget authority of $100 M for this period. This modernization program addresses needs primarily related to the many buildings and utilities that are 20-40 years old and need improved safety, mechanical, electrical, and structural systems to meet current design standards. Full modernization of the main site requires a long-term 20-year investment program. Individual projects are evaluated against CFP priorities: (1) safety systems and safety facilities, (2) environmental protection, (3) utilities reliability, (4) design standards and obsolescence, and (5) delivery of research and support services.
  - *MEL-FS Building Replacement and Rehabilitation*. During the near term Berkeley Lab's modernization plans call for construction to improve the safety and facility services infrastructure. The plan includes removal of obsolete, inefficient, and substandard facilities that cannot be made adequate and replacement of temporary structures for support activities.
  - *MEL-FS Safety Improvements*. Safety and Health improvements began in FY 1988 and include fire protection upgrades; hazardous materials control upgrades; removal of asbestos; and improvements to safety services, medical services, building illumination, radiation protection, water-pollution control, and monitoring. Seismic stabilization of steep slopes began in FY 1991. Road improvements include widening, replacement of base materials, and elimination of acute curves and blind spots.
  - *MEL-FS Electrical Utilities* —In the next five years, the Berkeley Lab main-site electrical power system upgrade plan calls for the completion of the first three phases and work to begin on the fourth phase of a six-phase program which will result in the upgrade of the underground 12-kV power distribution system and the installation of six new circuit breaker switching stations throughout the site. The upgraded switching and distribution system will provide the reliability, flexibility, and expandability necessary for efficient Laboratory operation and future growth.
  - *MEL-FS Mechanical Utilities* — Mechanical utilities comprise domestic and cooling water, low-conductivity water, storm drains and sanitary sewers, natural gas, compressed-air, and vacuum systems. These utilities are up to 40 years old, and many are undersized for current Laboratory demands. The modernization plans provide for the orderly replacement of these utilities and will help prevent potential damage to the environment. Scheduled utilities improvements only correct existing deficiencies; any delays will engender further deterioration of these essential utilities.
- *General Plant Projects (GPP)*. GPP funds are provided by DOE to fund priority construction projects that have a funding ceiling of $2.0 M. Funding to date has been inadequate to meet the Laboratory needs within a timely schedule. This program has a significant backlog of approximately $30 M in projects. Roughly a quarter of this backlog is for environment, health, and safety needs; a half is for utilities safety and reliability, building maintenance, and standards compliance; and a quarter is for multiprogram support facilities and small programmatic projects and additions. In FY 1993 more than half of the $3.3 M GPP budget was used for ES&H-related projects. In FY 1994 the majority of funds will be for infrastruc-

ture improvements to extend their useful life, and to bring older buildings up to code and research support requirements. The available funds cannot meet current project needs and do not allow progress in reducing this backlog. In fact, as line item projects that would address deficiencies and aging infrastructure are deferred, some of these capital support requirements must shift to GPP funding to maintain system effectiveness, minimize secondary deterioration, and control safety and environmental risks. Increasing GPP funding to $6 M annually would ensure the success of the Laboratory's safety rehabilitation program and help reduce the current backlog of projects over the next five years. Support and coordination for both programmatic and institutional GPP through the Office of Energy Research facilitates effective management of GPP needs.

- *General Purpose Equipment (GPE)*. In the past, essential support equipment has been funded through DOE's Nuclear Physics Division. Berkeley Lab's Five-Year GPE Plan identifies needs based on a range of criteria, including environment, safety, and health; legal requirements; failed, worn, inefficient, or obsolete equipment; substandard performance; or increased workload and demand. The current funding level of $1.7 M /year minimally meets the Laboratory needs. Currently there is a $19 M equipment backlog for environmental monitoring and fire safety, physical plant, transportation, and data processing and communications. The recent redefinition of appropriate GPE projects eliminated a large number of infrastructure needs from eligibility. These needs continue to exist, and their transfer to the maintenance and operating budgets has significantly strained these resources. The maintenance and infrastructure backlogs are now lengthy. Increased DOE support of non-capital (non-GPE) infrastructure and equipment projects would provide a basis for reducing this backlog. For FY 1994, consolidated GPE management at the level of the Office of Energy Research will facilitate the implementation of an integrated and longer-range GPE plan.

1. INTRODUCTION AND REGIONAL CONDITIONS

BACKGROUND/**H**ISTORY

The Ernest Orlando Lawrence Berkeley National Laboratory is a national laboratory operated by the University of California (UC) for the U.S. Department of Energy (DOE). The Laboratory is an independent academic unit of the University of California system and is located adjacent to the University of California, Berkeley (UCB) Campus.

Berkeley Lab began as an accelerator laboratory in 1931, when Ernest O. Lawrence established the Radiation Laboratory with the construction of the 27-Inch Cyclotron on the UCB Campus. In 1939 the need for higher-energy accelerators resulted in the construction of the 184-Inch Cyclotron on a hill overlooking the campus and the City of Berkeley. Driven first by pioneering nuclear physics and biophysics research, then by the Manhattan Project during World War II and later by high-energy physics, the Laboratory's growth continued until about 1967. During the period of rapid growth, between 1940 and 1946, the original hillside Laboratory site became crowded with temporary wooden buildings hastily erected in response to national defense needs. However, development during the 1950s was more carefully planned, with the construction of permanent concrete and steel-frame structures east and west of the earlier construction. Figure 1-1 is an aerial view of the Laboratory.

Under the auspices of the Atomic Energy Commission, Berkeley Lab's largest accelerator, the Bevatron, became operational in 1954 as the nation's leading high-energy physics facility. The Heavy Ion Linear Accelerator (HILAC) was completed in 1958, and the 88-Inch Cyclotron was completed in 1964. These facilities have been modernized and have continued to make important contributions to nuclear physics research. However, the Bevalac was closed in FY 1993, and decommissioning plans are under way.

There was a period of reduced program activity at the Laboratory from the late 1960s through the early 1970s, as much of the nation's high-energy physics research moved to other laboratories with larger accelerators. In 1974 the Bevatron was combined with the HILAC to form the Bevalac, and the Laboratory regained its position as one of the world's premier accelerator facilities, this time for heavy-ion nuclear physics research.

In response to the 1973 oil embargo, several new research programs broadly relevant to national energy supply and end-use were initiated in 1975, following the reorganization of the Atomic Energy Commission into the Energy Research and Development Administration and the Nuclear Regulatory Commission. The Laboratory grew to its largest population in 1979, following the establishment of the DOE, but no permanent buildings were constructed to accommodate this growth; temporary buildings and leased space in the cities of Berkeley and Emeryville housed some research programs and most support services. By 1980 only 25% of the Laboratory's programs were in high-energy and nuclear physics, down from 75% in 1970. The Laboratory had become a multiprogram national laboratory, with a fundamental shift in mission since long range development plans were initially prepared in the 1950s.

From 1980 to 1982, Federal support for energy research dropped precipitously, and basic research declined, resulting in a 19% reduction in Berkeley Lab's work force. Subsequently, the Laboratory's planning reemphasized basic, laboratory-based research founded on Berkeley Lab's multidisciplinary scientific strengths. These plans called for the development of basic energy sciences and life sciences while maintaining historically important roles in high-energy and nuclear physics. In 1984 the National Center for Electron Microscopy was completed. The strongest of the energy-conservation and environmental-research programs in building sciences, energy storage, and indoor air quality that had developed during the 1970s were retained into the 1980s. Plans were initiated for facilities in support of research programs with long-term potential for contributing to the nation's capabilities in materials science, chemistry, biology, and the earth sciences.

Fig. 1-1. Aerial view of the Ernest Orlando Lawrence Berkeley National Laboratory.

This diversification toward multiprogram research activities and the development of the basic energy sciences are reflected in the Laboratory budgets over the past two decades. Over the past decade the Laboratory has emphasized the need for increased capital investment in its physical plant (compared to the low funding during the late 1960s and 1970s) to revitalize existing facilities and to build major new research facilities to support DOE's programs. The Comprehensive Facilities Plan (CFP) provides guidance for using these capital funds effectively and for accommodating the significant changes in the Laboratory's mission. It updates the 1987 Long Range Development Plan (LRDP).

The role of the Laboratory is now broad, and Berkeley Lab provides national scientific leadership and technological innovation in support of its mission to:

- Perform leading multidisciplinary research in the energy sciences, general sciences, and biosciences in a manner that ensures employee and public safety and the protection of the environment. The energy sciences include materials research, chemistry, earth science, and energy and environmental research. The general sciences include nuclear and high-energy physics and accelerator research. The biosciences include the life sciences and structural biology research.
- Develop and operate unique national experimental facilities for use by qualified investigators from throughout the world, including the Advanced Light Source, the National Center for Electron Microscopy, the 88-Inch Cyclotron, and the National Tritium Labeling Facility.
- Educate and train future generations of scientists and engineers to promote national science and educational goals. 440 graduate students pursue research at Berkeley Lab with about 100 students receiving advanced degrees each year. Precollege programs are conducted for science educators and students.
- Transfer knowledge and technological innovations, and foster productive relationships between Berkeley Lab research programs, universities, and industry to promote national economic competitiveness. The Center for Advanced Materials, the Center for X-Ray Optics, and the California Institute for Energy Efficiency are examples of collaborations with industry. Technology transfer programs promote the application of research results.

REGIONAL OVERVIEW

The western United States, notably California and the San Francisco Bay Area, strongly influence science and engineering research and development in the Pacific Basin. Berkeley Lab has the advantage of being situated close to high-technology industries in the microelectronics, biotechnology, aerospace, telecommunications, petroleum, and advanced materials development fields (Figure 1-2). This exciting research and development environment is enhanced by the desire of Japan and the developing Pacific Rim countries to develop and use new technologies. High-quality academic, private, and Federal research and development programs create a San Francisco Bay Area job market that attracts a first-class labor pool. Interactions are facilitated by regional transportation systems and comprehensive telecommunications and computing resources. Necessary raw and finished materials and equipment are in most cases readily available because of the high local demand these research activities generate. The demographic and economic assumptions represented in Table 1-1 indicate a high mean household income, increasing population growth rate, and increasing labor force, through the year 2005. San Francisco Bay Area housing characteristics are shown in Table 1-2.

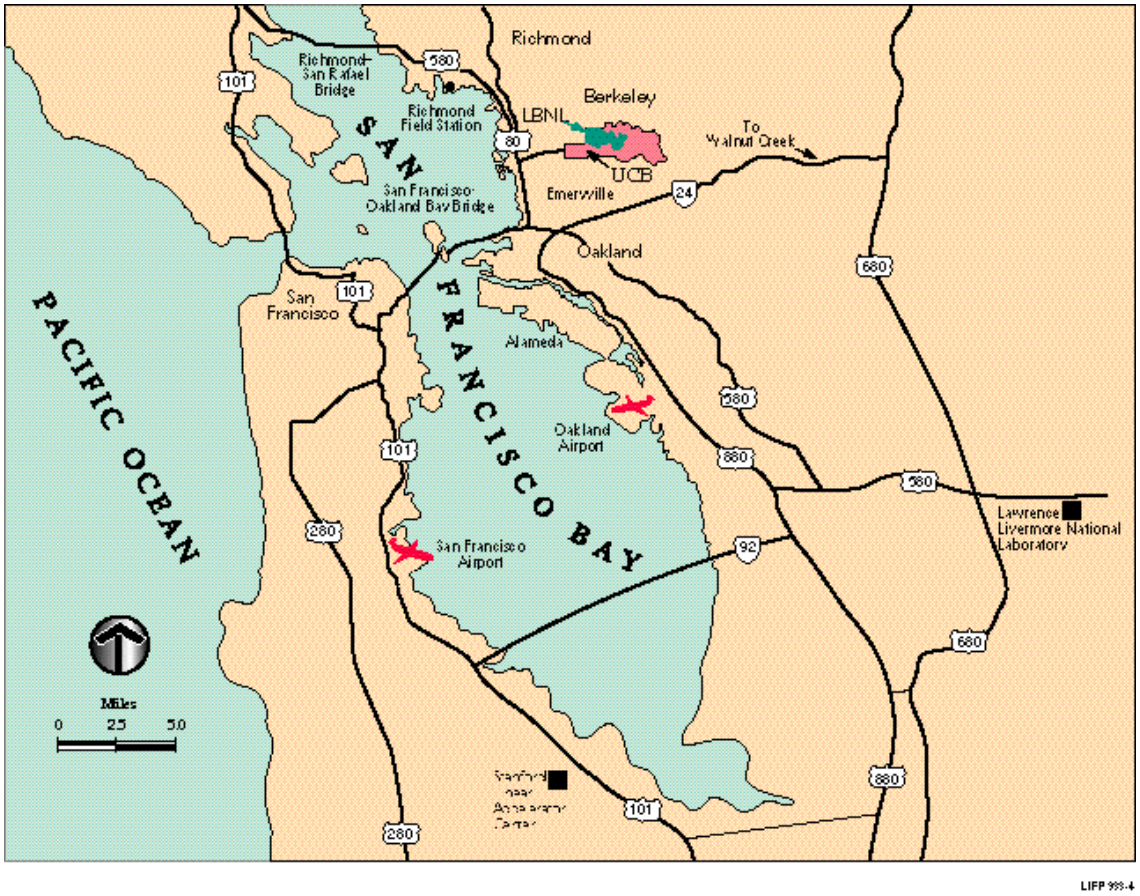


Fig. 1-2. Regional map.

Table 1-1. Demographic and Economic Assumptions and Projections, San Francisco Bay Area.[a]

Demographic Projections	1985–1987	1988–1990	1991–2005
Annual Growth Rate in Labor Force Participation	2.1%	1.8%	1.2%
Net Annual Regional Migration	34,600	31,800	34,800
Population	5,531,950	5,911,200	6,492,400
Labor Force	3,035,600	3,332,300	3,912,100
Mean Household Income	$39,200	$41,300	$47,400
Percent Change in Regional Household Size	–0.47%	–0.73%	–0.75%
Economic Projections			
Annual Growth Rate in All Gross Exports	3.2%	4.6%	5.0%
Annual Growth Rate in High Tech and Information Technology Exports	3.7%	6.0%	6.4%
Annual Energy Cost Increases in Current $	Stable	5% greater than inflation	5% greater than inflation
Annual Growth in Capital Spending	5.4%	6.6%	4.6%
Annual Growth in Gross Regional Product	2.9%	2.9%	3.2%

[a]Association of Bay Area Governments (ABAG), Projections for the San Francisco Bay Area to the Year 2005, July 1987.

Technology transfer to and from industry is enhanced in many cases by the proximity of many industrial organizations. Graduate students, postdoctoral associates, and professors from many other U.S. and foreign universities benefit from involvement with Berkeley Lab research programs and user facilities. The UC system comprises nine top-rated campuses, including four medical schools, with a wide variety of scientific strengths. The Laboratory has strong interactions with other top California universities, such as Stanford and the California Institute of Technology.

Table 1-2. San Francisco Bay Area Housing Characteristics.

		Housing Units (Thousands)						
County	Population	Total	Single	2 – 4	>5	Mobile Homes	% Vacant	Pop./H-Hold
Alameda	1,313	507	300	60	141	6.9	4.8	2.6
Contra Costa	837	324	235	23	59	7.5	4.6	2.7
Marin	237	101	70	8	21	1.7	4.7	2.4
Napa	115	45	33	3	5	3.9	6.4	2.6
San Francisco	729	332	105	79	147	0.1	7.0	2.3
San Mateo	670	254	166	17	67	3.5	3.9	2.7
Santa Clara	1,532	548	354	42	131	20.8	3.7	2.8
Solano	365	125	90	11	19	4.6	4.7	3.0
Sonoma	407	167	124	11	21	11.9	7.2	2.6

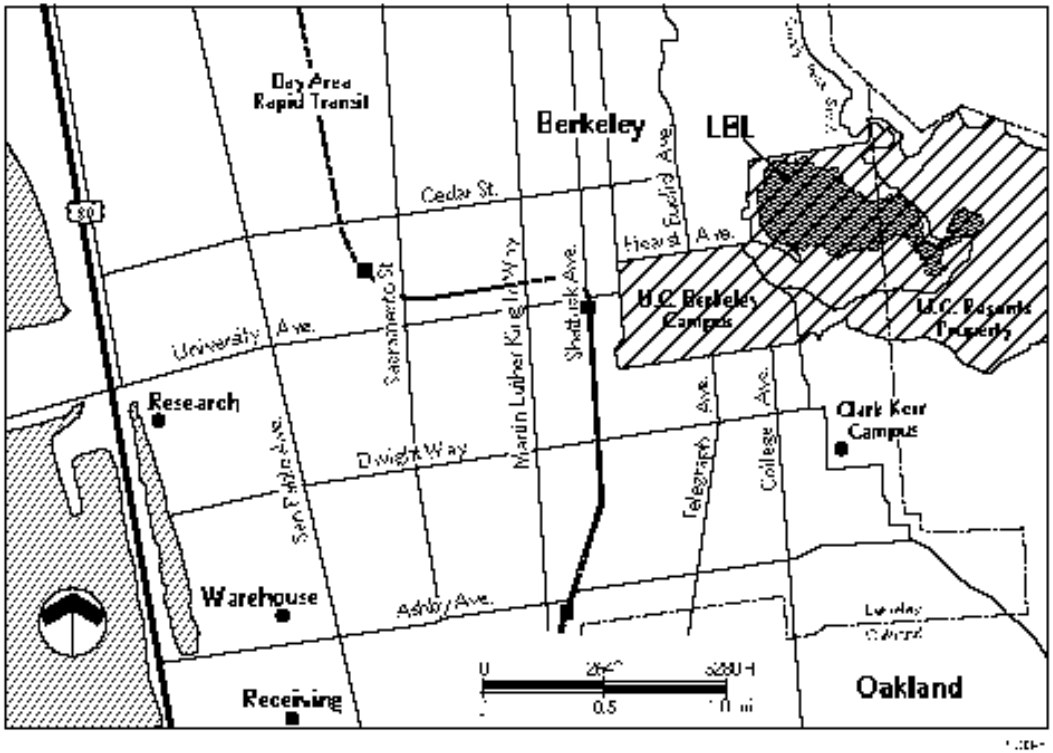
California Department of Finance Demographic Research Unit, April 28, 1992.

VICINITY OVERVIEW

San Francisco Bay Area

Berkeley Lab is located five kilometers east of San Francisco Bay on the slopes of the Coast Range within 479 hectares (1183 acres) of contiguous UC land. Most of the Laboratory's main-site buildings are owned by DOE and were constructed on University land under long-term lease to the Federal government (Appendix D). The Laboratory's 54 hectare (134-acre) site is in Alameda County, with the eastern portion of the site in Oakland and the Western portion in Berkeley, largely a university and residential community with a population of 103,000 (Figure 1-3). Research is also conducted in buildings on the UCB campus, (student population 31,500), and at the Richmond Field Station, a University facility within the City of Richmond, about five kilometers north of Berkeley.

The San Francisco Bay Area is a cosmopolitan region comprising nine counties with a total land area of 1.9 million hectares (4.6 million acres) and a population of 6.0 million. Although metropolitan areas are highly developed, only 12% of the total land has been developed as residential area, commercial, industrial, or highways. The highly diversified, technology- and service-oriented labor force of the region totals 3.3 million people. The industrial base is not oriented toward cyclically sensitive heavy industry but toward



Vicinity Map.

Fig. 1-3. Vicinity map.

high technology. Aerospace, computers, electronics, scientific instruments, and communications equipment comprise more than 50% of all manufacturing jobs.

The Bay's topography consists of a valley 145 kilometers (90 miles) long formed between two geological faults—the San Andreas fault, along the San Francisco Peninsula and Marin County, and the Hayward Fault, along the East Bay Hills. The coastal ranges surrounding the Bay reach to 1283 meters (4,210 feet). The Bay itself covers 673 km^2 (260 square miles) and moderates the local climate. The East Bay, comprising the Counties of Alameda and Contra Costa, is a large and diversified area but shares such features as a common water distribution system, unified public transit systems for buses and rail transit, and a unified regional park system.

Alameda County, with a population of 1,280,000 and an area of 189,950 hectares (469,400 acres), has major educational, research, industrial, and agricultural resources, including six colleges and universities, large private and public research laboratories, heavy and light industry, and extensive nursery and viticulture acreage. Important industries include electronics, automobile assembly, biotechnology, and food processing. Alameda Naval Air Station is home base for several aircraft carriers of the Pacific Fleet. The civilian labor force is approximately 600,000. The annual population growth rate during the mid-1980s was 7%. Most of the growth is projected for the southern area of

the county. The Alameda County Planning Department prepares General Plans that are primarily directed toward the unincorporated areas of the County. The County General Plan for the Central Metropolitan, Eden, and Washington Units was prepared in 1981 and includes the communities and area surrounding Berkeley Lab. These plans include land use, noise, scenic routes, and housing.

Cities of Oakland and Berkeley

Oakland is the county seat and, with a population of 372,000, is the sixth largest community in California. The port of Oakland can accommodate any vessel in the Pacific trade fleet, and three transcontinental railroads serve the city. The annual population growth rate during the mid-1980s was 1%. Growth in Oakland is expected to occur primarily in the vicinity of the airport, in the Harbor Bay Isle Business Park, and in Downtown Oakland. Oakland is a member of the Association of Bay Area Governments. The principal planning document of the City is the Oakland Master Plan.

Berkeley is a residential, university, and industrial city encompassing 2,720 hectares (6,720 acres). The City is best known for the University of California. Industries include major biotechnology, electronics, chemical and pharmaceutical companies; small foundries and fabrication companies; and other high-technology companies and service industries. The population of Berkeley has not changed during recent years. Berkeley is a member of the Association of Bay Area of Governments. The principal planning document of the city is the Berkeley Master Plan (1977), which is now being updated. Berkeley has also prepared a Draft Berkeley Downtown Plan, the Housing Element, and various neighborhood plans. The Laboratory is exempt from local zoning and planning regulations but cooperates with the Cities of Berkeley and Oakland, and with other local communities, on matters of mutual concern.

The Laboratory is sited on the ridges and draws of Blackberry Canyon, which forms the central part of the site, and Strawberry Canyon, which generally forms the southern boundary. The area to the south, which is University land, is maintained largely in a natural state and includes recreational facilities and the University Botanical Garden. Above and to the east of the Laboratory are located the University's Lawrence Hall of Science and the Mathematical Sciences Research Institute. Berkeley Lab is bordered on the north by predominantly single-family homes and on the west by multiunit dwellings, student residence halls, and private homes.

The eastern section of the main Laboratory site is located along the northeast boundary of Oakland. Although the area is largely urban, the Laboratory site has a backdrop of botanical gardens and regional parks that preserve the rural character of the foothills.

The Laboratory is served by a network of state, county, city, University, and Berkeley Lab roadways and public, University, and Laboratory transit services. The Laboratory is within commuting distance to the Lawrence Livermore National Laboratory and the Stanford Linear Accelerator Center. The DOE field office at Oakland (DOE/OAK) is located in Oakland. In addition DOE/OAK maintains offices and staff at its Site Office at Berkeley Lab.

NATURAL FEATURES AND LAND USE

Berkeley Lab's hillside location, with elevations ranging from 150 to 300 meters (500 to 1000 ft) above sea level, affords dramatic views of neighboring San Francisco Bay. The Berkeley Lab site is drained by the west and south branches of Blackberry Creek and by Strawberry Creek, and is underlain by folded sedimentary and volcanic rock that has weathered to form soils several feet thick.

The hillside topography and vistas are both an amenity and a constraint and add an important dimension to site planning at Berkeley Lab. Grading and filling are necessary to provide most building sites, and a slope-stabilization program that includes shallow dewatering wells, vegetation cover, and soils management is critical to site management. The Hayward fault (a part of the active San Andreas fault system), which developed as the

Berkeley Hills were uplifted, is at the western edge of the main Berkeley Lab site. Buildings and building additions will not be sited across the fault. Originally the site was coastal shrubland, but during the last 100 years the area was extensively grazed by cattle and, except near creeks, became primarily grassland. Since the 1950s the halt of grazing and subsequent land management have resulted in the growth of trees, especially eucalyptus, oak, and evergreens. Control of this vegetation is an important element of the Hillside Fire Management Plan. Deer, various small mammals and reptiles, and birds populate the Laboratory site and the adjacent hills. There are no threatened or endangered species that have been identified in or adjacent to the Berkeley Lab Site.

Adjacent land use consists of residential, institutional, and recreation areas (Figure 1-4). Development within the Laboratory site is governed by guidelines (see Chapter 2) that were developed with the understanding that operations must be compatible with the surrounding community. Visually the Laboratory is associated by the public with the UCB Campus, and the Laboratory works with municipal, county, and university planning staffs to maintain and improve relationships and to coordinate development plans.

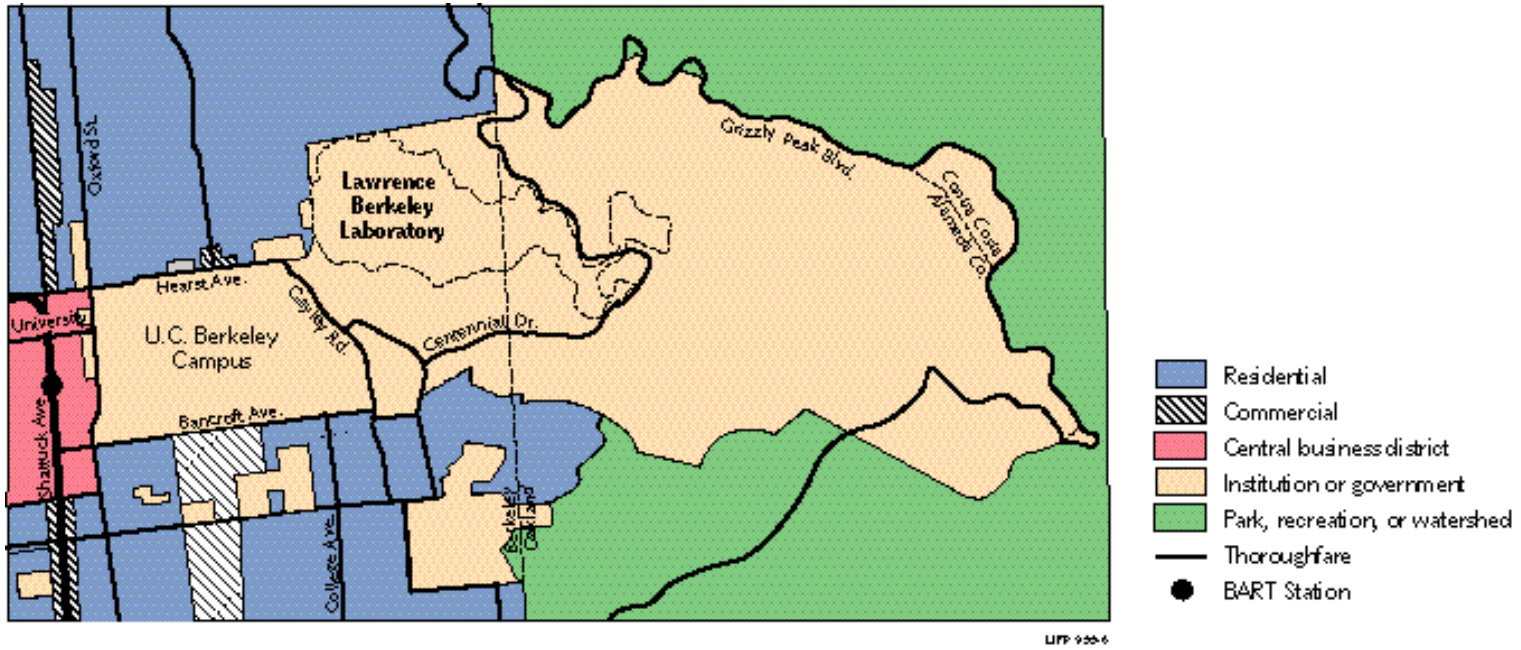


Fig. 1-4. Adjacent land use.

RELATIONSHIP WITH THE COMMUNITY

Overview

UCB is immediately adjacent to Berkeley Lab and is the largest employer in the City of Berkeley. It is the second largest campus of the 9-campus/3-laboratory UC system and has an enrollment of about 31,500 students. The academic staff is 4,344, and the total number of employees is 10,785. The University maintains its own planning department and is in the process of revising its Long Range Development Plan (LRDP) issued in 1990. The Laboratory works with the University on matters of mutual planning concern, provides advance notice during the planning stages of Berkeley Lab construction projects, and seeks input from the University for Berkeley Lab's SDP.

The Laboratory and UCB interact to develop plans and programs of mutual benefit. These involve elements of scientific program plans as well as facilities and environmental issues. The Laboratory's 1987 LRDP was presented for discussion before the UCB Campus Planning Office Staff and the Chancellor's Planning Committee. Three development programs have been identified during the SDP preparation and review process: fire-safety coordination, traffic, signage and parking management, and historical preservation. The Laboratory's Site Development Plan and this CFP maintain the same Berkeley Lab population growth projection, Laboratory building area, and land use plan consistent with the Regents' approved 1987 LRDP for Berkeley Lab. The DOE planning documents provide the implementation framework for the Regents approved plan.

A historic preservation review of the 184-Inch Cyclotron Building (Building 6) conducted by an independent consultant in 1987, makes recommendations to ensure Berkeley Lab's compliance with environmental quality-assurance guidelines. Additional background and planning documents for fire prevention, parking and traffic control, and historical preservation are included in Appendix A.

The Laboratory also recognizes its responsibility to make its facilities available to the nonscientific public through tours and educational programs. For example, the Laboratory operates science education programs for extending precollege, college, and graduate level education programs to both teachers and students. The Laboratory also provides school and public tours for over 3000 visitors annually to learn about Berkeley Lab facilities and research.

It is the policy of the Laboratory and the University to cooperate with local agencies on planning matters of mutual concern. The Laboratory's planning staff meets with the UC Berkeley Neighborhood Liaison committee to inform the citizens of bordering communities of major changes to the site. To facilitate smooth transitions in changes to the site, Berkeley Lab planners communicate and coordinate activities with the cities of Berkeley and Oakland, UCB, and DOE/OAK.

Security and Fire Protection

Berkeley Lab is part of the Alameda County mutual aid system. Security and fire protection services in the area are provided by Police and Fire Departments of the cities of Oakland and Berkeley, by the Alameda County Sheriffs Department, and by the California Highway Patrol. The Oakland Police Department has a staff of 600 officers, and its central command center is in Downtown Oakland. The Oakland Fire Department has 476 firefighters organized into 23 engine companies and 7 truck companies. Three engine companies and a truck company are within 5 kilometers of the Laboratory. Berkeley Lab, with its own fire services, has reciprocal agreements with Berkeley and Oakland to cooperate on fire response.

The Berkeley Police Department has 175 officers and is located in the downtown Civic Center. The Berkeley Fire Department has 129 firefighters, 7 engine companies, 2 truck companies, and 3 ambulances. Three Berke-

ley engine companies and one truck company are located within 1.6 kilometers (one mile) of the Laboratory. Local emergency preparedness is coordinated through the Alameda County Office of Emergency Services, with a command center in Oakland. The area is a part of Region 2 of the State Office of Emergency Services, which has its regional command center in Pleasant Hill in Contra Costa County. Berkeley Lab conforms to Region 2 emergency plans and has communications access to the statewide emergency communications network.

The Laboratory maintains a Fire Department, and the University maintains a Police Department on campus with a continuing dedicated patrol at Berkeley Lab during all 3 daily 8-hour shifts to maintain 24-hour security at the Laboratory. Facilities and equipment include guard stations at the three gates and patrol vehicles.

The Berkeley Lab Fire Department occupies two buildings totaling 700 gsm (7500 gsf). It provides fire protection, basic life support, and ambulance services to the Laboratory and provides supervisory monitoring of the fire alarm and sprinkler systems in Laboratory buildings. In addition, it assists the local municipal fire departments in controlling an average of 3–4 fires annually in the neighboring communities. The Laboratory's fire protection and ambulance capabilities will continue to be available to augment local community services. Fire, safety, and emergency preparedness long-range plans are summarized in Chapter 4.

Fire safety measures are designed to minimize the severity of fires originating along roadways or from adjacent property. Although the natural vegetation areas between Berkeley Lab and nearby residences are outside Berkeley Lab's jurisdiction, the Laboratory assists UCB and Berkeley and Oakland with fire safety measures. The Laboratory has agreed to provide backup fire control/patrol teams and equipment during controlled burns. Historically, the Laboratory's Fire Department has responded to calls for assistance from local fire departments and is committed to continue to do so. The Laboratory is cooperating and participating with the City of Berkeley and UCB in their Fire Management Plan for the UC Hill Area. In addition to scheduled controlled burns coordinated with UCB, plans include the planting and maintenance of fire resistant vegetation to create a firebreak between the Laboratory fence line and adjacent grassy slopes. A specific program of fuel reduction is in place following the 1991 fire in the Oakland Hills.

Public Utilities

The Laboratory's primary water supply is from the East Bay Municipal Utility District (EBMUD). Natural gas and electricity are provided via Pacific Gas and Electric Company (PG&E) transmission lines. Berkeley Lab purchases most of its electricity from the Western Area Power Administration (WAPA). Gas is purchased from the Defense Fuel Supply Center (DFSC). Berkeley Lab's sanitary sewers connect to the City of Berkeley system, which terminates at a sewage treatment plant in Oakland. The Berkeley Lab storm drains empty into Blackberry and Strawberry Creeks, which flow into the City of Berkeley system and then into San Francisco Bay. A revitalization of on-site utilities has been initiated through the MEL-FS and GPP programs, as described in Chapters 4 and 5.

EBMUD supplies water to Berkeley Lab primarily from large-capacity reservoirs (260 million m^3) (68 trillion gallons or 210 thousand acre feet) in the Sierra Nevada foothills. Water is transported via 150 km (90 miles) of aqueducts to 5 local reservoirs. The system supplies 20 communities, comprising 1.1 million people (348,000 water meters) in an 821-km^2 (317 square-mile) service area. Average use is 830 million m^3 (219 billion gallons) per day during high use years. During a recent drought, customer conservation incentives reduced consumption to 685 million m^3 (181 billion gallons) per day. Additional local storage capacity is planned with the construction of three new reservoirs. Berkeley Lab uses approximately 380 m^3 (100,000 gallons) of water per day.

While most electrical service is provided by WAPA, PG&E makes up the rest. All power to Berkeley Lab is firm. PG&E serves 48 counties in California, which have a popula-

tion of 11 million, and has a system-wide generating capacity of 21,700 MW. The East Bay service region of PG&E (Contra Costa and Alameda Counties) has a peak demand of 3,000 MW and annually consumes 15 million MW hours of electricity. The Laboratory had a peak demand of 20 MW and consumed 84,000 MW hours of electricity in FY 1992. Average demand was 14 MW. The Laboratory is fed by a dedicated 60-MW PG&E substation. PG&E has ample capacity to meet anticipated demand for the foreseeable future. Electricity rates are regulated by the California Public Utilities Commission. Berkeley Lab consumed 3.67 million cubic meters (130 million cubic feet) of natural gas in FY 1991, supplied by the DFSC.

Public sewers connect to the Laboratory at Hearst Avenue and along Strawberry Canyon. The City of Berkeley is in the 8th year of a 20-year rehabilitation program to modernize and increase capacity of the sanitary-sewer drain system. Sanitary sewer wastes are disposed of by EBMUD. The dry weather primary treatment capacity is 1.1 million m^3 (300 million gallons) per day. Secondary treatment capacity is 650,000 m^3 (170 million gallons) per day. Typical daily treatment flows to the system are 340,000 m^3 (90 million gallons) per day. Wet weather flow can exceed capacity during some storms. The Utilities District has initiated a five-year program to construct additional wet weather facilities to handle the expected increases from contributing communities. With the new facilities the peak wet-weather treatment capacity will be 1.6 million m^3 (415 million gallons) per day, which, with the new retention capacity, will accommodate a total flow in the sewer system of 2.9 million m^3 (775 million gallons) per day during storms.

The Laboratory owns and operates its own voice, data-communications, and computer-network telecommunications systems. The Integrated Communications System (ICS) provides voice and data services and links with external networks, including Pacific Bell (the local telephone company), AT&T, and the Federal Telecommunications System. LBLnet is a Laboratory-wide computer network connected through gateways to external networks, including HEPNET, NSFNET, MILnet, BARRNet, ESnet, and the UCB Campus network.

Transportation Systems

The Laboratory and the City of Berkeley are served by Bay Area Rapid Transit (BART) trains, regional and local bus services, many trucking companies, three major airports (San Francisco, San Jose, and Oakland International Airports) with frequent ground transportation to Berkeley, and two major railroads (Figure 1-5). The Laboratory operates a shuttle-bus service to downtown Berkeley, which is served by 15 local transit routes.

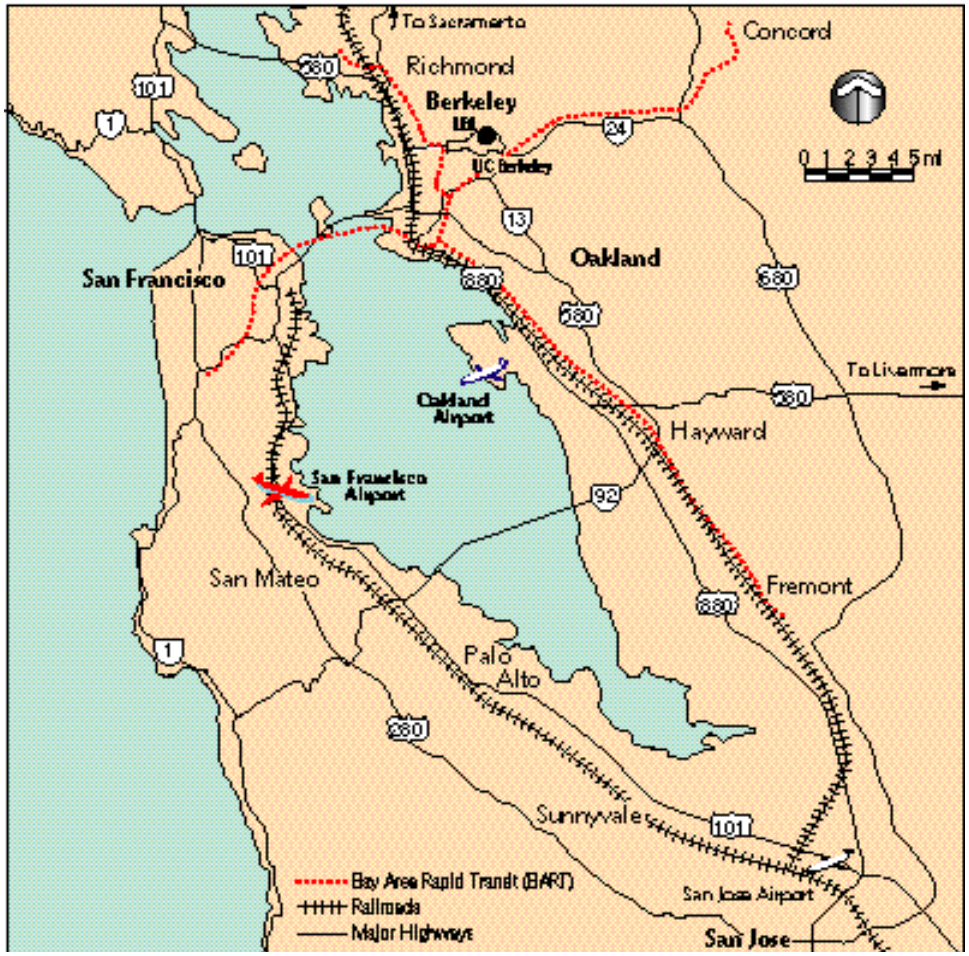


Fig. 1-5. Public transportation map.

BART is an automated rapid rail transit system with 115 km (71.5 miles) of double track serving 34 stations in Alameda, Contra Costa, and San Francisco Counties. The system provides approximately 200,000 passenger trips per day and maintains 440 rail cars. Three stations are located in Berkeley and are within 3.2 km (2 miles) of Berkeley Lab. Laboratory shuttle buses provide transportation to and from the downtown station. Planned extensions to San Mateo County and in Alameda and Contra Costa Counties include 6 new stations and 40 km (26 miles) of track.

The Alameda-Contra Costa Transit District is the largest bus transit service in the Bay Area and operates a fleet of 830 buses over a system with 3,540 directional street-kilometers (2,200 miles). The system provides service at 7000 bus stops for approximately 220,000 passengers per day. The bus stops adjacent to the Lawrence Hall of Science and at Hearst and Gayley roads are approximately 100 m (100 yards) from Laboratory entrances.

Access to Berkeley Lab is via three gates: the main entrance, Blackberry Gate, off Hearst Avenue (which becomes Cyclotron Road), directly east of the UCB campus; Grizzly Gate, off Centennial Drive; and Strawberry Gate, also off Centennial Drive. The site is served by a serpentine road pattern that conforms to the hilly topography. Approximately 50% of Berkeley Lab employees and guests live within a 6.5-km radius (15-minute driving time) of Berkeley Lab. Although Berkeley Lab is served by excellent public transportation

systems and its own shuttle-bus service to the UCB Campus and downtown Berkeley, the majority of Laboratory employees and guests use automobiles for transportation to and from work.

Berkeley Lab's Transportation Systems Management Committee has been working to identify ways to reduce Berkeley Lab single-occupant vehicular traffic while fully meeting the transportation needs of Berkeley Lab employees. A full-time Transportation Systems Management Coordinator develops and promotes traffic and parking mitigation measures. Program development thus far has included a Laboratory-wide employee transportation survey, quarterly traffic counts at the three Laboratory gates, a computerized ride matching system, participation in a state-wide ride sharing promotional event, Laboratory newsletter features, and new-employee orientations.

Further program elements may include a two-person vs. three-person carpool system, preferential carpool parking, expanded bicycle paths, additional bicycle storage, encouraged use of flextime to reduce congestion during peak traffic periods, and subsidized transit passes. Long-term elements may include new parking structures, increased shuttle-bus service, off-site parking facilities, a mini-cafeteria to service outlying areas, and a telecommuting program.

The transportation and parking plans and safety services are intended to minimize neighborhood traffic congestion, to improve parking access within the site, and to protect University and DOE property. Traffic problems are a major concern to the City of Berkeley because of existing congestion on routes to the University and Laboratory. Berkeley Lab has agreed with the City to limit the impact of additional staff in traffic during peak periods. The on-site and off-site shuttle buses greatly facilitate access to the Laboratory from the Campus and downtown Berkeley. Completion of existing parking and building projects should eliminate the need for roadside parking over the next several years, and completion of the long-range parking improvements would provide adequate parking for estimated growth.

REGULATIONS AND **P**LANNING **R**EQUIREMENTS

Berkeley Lab conducts its planning, operation, and construction activities in full compliance with Federal laws and regulations and with applicable state and local regulatory requirements. Specific DOE requirements are provided in enabling legislation, the Code of Federal Regulations, and orders and guidelines provided by the DOE. Current planning activities and SDP requirements are specifically established in DOE Order 4320.1B. In addition, the Laboratory's SDP has been developed in recognition of guidelines established in DOE's Site Development Planning Handbook and in planning management meetings and discussions. This CFP incorporates DOE/ER directives, established in DOE Order 4320.2, regarding the Capital Asset Management Process (CAMP). Berkeley Lab facilities planning is conducted consistently with the 1992–1997 operating contract between the Department of Energy and the Regents of the University of California (contract DE-AC03-76SF00098).

Berkeley Lab construction projects and site development activities are reviewed by the DOE, other Federal agencies, by state and local government, and by the public, using procedures and documentation requirements established by the National Environmental Policy Act (NEPA). As required by the University of California in its management of the DOE laboratories, plans and specific projects may also undergo review in consistency with the CEQA. These acts provide for the common development of environmental documentation to minimize duplication and to provide for lead-agency jurisdiction by the DOE. Regulatory and planning activities involve the following principal agencies:

Federal

- Department of Energy. Comprehensive oversight, audit, appraisal, and compliance responsibilities for program activities; site planning, construction and asset management; NEPA compliance; environmental, safety, and health planning and operations; radiation protection; facilities maintenance; personnel; legal affairs; and budgeting and other administrative activities. DOE require-

ments, reviews, and appraisal activities form an important basis for staffing levels and costs and the schedule of implementation of Berkeley Lab direct and indirect operations. The DOE/OAK Engineering and Facilities Management Division coordinates an annual review of Berkeley Lab's site planning program.

- Environmental Protection Agency. Standards for solid, liquid, and gaseous waste, National Pollution Discharge Elimination System permits, notification and emergency spill response, and requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Regulations promulgated by EPA help define Berkeley Lab environmental, health, and safety policies and affect costs and staffing of Berkeley Lab programs.
- Department of Labor. Occupational safety and health surveillance carried out by DOE in accordance with a Memorandum of Understanding with the Department of Labor. Occupational health and safety standards, including construction standards for the handicapped, are an essential part of Berkeley Lab construction planning and program operations.
- Department of Transportation. Shipping and waste-handling requirements and procedures. DOT standards define the requirements for shipping materials off site and influence schedules, costs, and activities for wastes from demolition, hazardous-waste handling, and other facilities and procedures.

State

- University of California. Site planning and facilities design review and approval; environmental review procedures and approval (CEQA); health and safety policies review and approval; personnel policies and procedures; budget policies and procedures review, approval, and audit; program review; and review and approval of other administrative policies and procedures.
- California Environmental Protection Agency (Cal-EPA). Established in 1991 and coordinates integrated waste management, water resources control, air resources, toxic substances control, pesticide regulation, and environmental health and hazard assessment.
- Department of Health Services. Issues waste-handling-facility permits, reviews environmental reports for compliance with CEQA. Facility and permit requirements determine the capability, design, and operation of Berkeley Lab sanitary and waste-handling facilities.
- California Water Quality Control Board and Regional Water Quality Control Board. As an element of Cal-EPA, issues discharge permits and reviews environmental reports in compliance with NEPA or CEQA.
- California Air Resources Board. As an element of Cal-EPA, develops statewide air-quality policies and reviews environmental reports for NEPA or CEQA. Emissions regulations influence the costs of monitoring and emissions-control equipment.
- California Public Utilities Commission. Governs rate structures and intrastate acquisition of natural gas and electricity.
- Department of Emergency Services. Coordinates emergency response planning (local coordinating office in Contra Costa County).
- Water Resources Board. As an element of Cal-EPA, reviews environmental reports for NEPA and CEQA.

Local

- Bay Area Air Quality Management District. Issues emissions permits, reviews environmental reports for NEPA and CEQA.
- East Bay Municipal Utilities District. Provides water supply, establishes water-use and sewer fees, approves and monitors discharges to the sanitary sewers.

- Alameda County Health Care Services Agency. Inspects sanitary facilities and food-handling operations, issues cafeteria operations permit.
- Cities of Berkeley and Oakland. Maintain surrounding city infrastructure, including roadways, local sewers, and public services; monitors compliance program for subsurface tanks and groundwater. The cities review CEQA documents and conduct a dialog with Berkeley Lab and the University in planning, transportation, and environmental matters.

To implement programs consistent with applicable requirements established by these agencies, the Laboratory conducts a wide range of operational activities, including review, education, and report programs; for example, environmental, safety, and health educational programs and the control and monitoring of all effluents, emissions, and solid-waste-handling activities.

The Laboratory also has established a Five-Year Long-Range Environmental Health and Safety Program that corrects existing deficiencies and makes longer-range projections for anticipated environmental requirements. These programs provide for utility systems improvements, such as improved ventilation and lighting, asbestos abatement, and soils cleanup and the removal of groundwater contamination resulting from activities conducted during past decades. These programs are being established and conducted consistently with the policies promulgated by the responsible local, state, and Federal agencies.

Berkeley Lab's construction schedules include provisions for NEPA review as required by DOE and for CEQA review, as required by the University. These reviews allow for participation by public and private agencies, groups, and individuals and afford the opportunity for public review and litigation, which can affect the schedule, mitigation measures, and the construction of facilities proposed in this plan. The general scope, total projected gross square feet, and the land use identified in this CFP are consistent with the 1987 LRDP, which has been approved by the UC Regents and has completed applicable Federal and state environmental review procedures, including issuance of an Environmental Impact Statement as required by UC.

For the renewal of the contract between DOE and the Regents of the University for management and operation of Berkeley Lab, a supplemental Environmental Impact Report was prepared. The report was based on information contained in the 1993 Berkeley Lab Site Development Plan, which is the current implementation plan of the 1987 LRDP, and other planning documents.

SITE-**D**EVELOPMENT **P**LANNING **G**OALS

The 1996 SDP and CFP are land use and facilities management guides for the main site that provide a comprehensive physical frame-

work for carrying out the Laboratory's mission for DOE.

Facilities planning is motivated by the need to develop facilities for DOE programmatic needs; to maintain, replace and rehabilitate existing obsolete facilities; to identify sites for anticipated programmatic growth; and to establish a planning framework under current environmental constraints in recognition of site amenities and the surrounding community.

The purpose of the CFP is to be a long-term guide for development of the main site, and provide information for use by staff and technical personnel as follows:

- Summarize the Laboratory's history, setting, and planning processes.
- Define the physical environment for facilities improvements on the main site.
- Indicate redevelopment analysis and needs for all assets, including buildings and utility systems.
- Summarize site amenities and constraints to protect the environment and landscape.
- Identify a long-term master plan and needs for future improvements, and outline a near-term 5-Year Plan.

The CFP presents a concise expression of the policy for the future physical development of the Laboratory, based upon anticipated operational needs of research programs and the environmental setting. It is a product of the ongoing planning processes and is a dynamic information source.

The 1997 CFP provides for new facilities associated with the Laboratory's redirection as a leading multiprogram laboratory. In addition, improvements are identified for rehabilitation and replacement of obsolete temporary buildings constructed since the 1940s. The site areas occupied by these proposed facilities are closely related to the 1987 LRDP, reaffirming the general framework established at that time.

2. EXISTING CONDITIONS

The Laboratory's research makes use of multidisciplinary collaboration and advanced engineering, computation, communications, fabrication, and other support facilities characteristic of a national laboratory. The Laboratory's facilities are planned, constructed, and maintained to support directly Berkeley Lab's research programs and scientific goals, while maintaining compatibility with the University community and the physical setting.

SUMMARY OF EXISTING ACTIVITIES

In support of the DOE and the nation's research and technology needs, Lawrence Berkeley Laboratory research programs fortify the foundations of energy and environmental technology and will continue to be supported primarily from the Office of Energy Research (OER) and the Assistant Secretarial Offices of Conservation and Renewable Energy, Civilian Radioactive Waste Management, and Fossil Energy. The Assistant Secretary for Environmental Restoration and Waste Management will be increasingly important to support of site-specific environmental restoration projects. In addition, other DOE offices and the Nuclear Regulatory Commission will support Berkeley Lab programs. Work for Others (WFO) supports about one-sixth of the Laboratory's programs. This section summarizes current Berkeley Lab research programs, including anticipated program trends. Berkeley Lab's scientific and technical programs are conducted under strengthened environmental, health, and safety guidelines for conduct of operations. Research facilities and programs are conducted to ensure the safety of all employees and the public, with environmental and safety management programs developed in close working relationships with OER.

Office of Energy Research

OER is the focus of fundamental science and engineering research activities at the Laboratory and is growing in selected areas of the Basic Energy Sciences and Life Sciences (see Chapter 3). Many of these programs are conducted in cooperation with industrial and academic research communities.

- For FY 1994 the Laboratory's contribution to national efforts in the Basic Energy Sciences (BES) includes bringing beamlines online at the Advanced Light Source (ALS) and developing advanced instrumentation user facilities to support scientists in chemistry, biology, materials research, physics, and other fields. The proposed Electron Beam Microcharacterization Facility will provide state-of-the-art electron beam instrumentation and laboratories for high-resolution study of advanced materials.
- In national health and environmental research, Berkeley Lab's human genome, structural biology, and cell and molecular biology programs continue to provide the technical capabilities to improve the understanding of environmental and genetic control of diseases and normal functions. These capabilities will be greatly enhanced with completion of the Human Genome Laboratory and ALS Structural Biology Support Facilities, now under construction. The biomedical program is improving diagnostic imaging systems and elucidating the metabolic basis of disease.
- The 88-Inch Cyclotron, with its Advanced Electron Cyclotron Resonance (AECR) ion source, provides the highest flux of heavy ions of any low-energy accelerator in the U.S. The Gammasphere detector, located at the Cyclotron, is opening up new research opportunities in nuclear structure. The relativistic heavy-ion research program will be pursued with the STAR experiment at the Relativistic Heavy-Ion Collider (RHIC) and with lead beams at CERN (NA49).
- High-energy physics research continues to make major advances in detector systems with plans for a B-factory detector. Berkeley Lab contributes to the operation of current forefront facilities, including the D-Zero and Collider Detector Facility (CDF) at Fermilab.
- In support of national fusion research goals, Berkeley Lab's programs in

heavy-ion fusion accelerator research for inertial-confinement fusion and in neutral-beam development for magnetic-confinement fusion is proposed to expand. These programs build on expertise in induction-linac systems and ion-source development.

- The Center for Advanced Materials (CAM) continues to pursue Laboratory goals for conducting long-term research responsive to industrial needs and transfer of the results to industry. CAM anticipates program expansion in thin-film research, studies of wear and mechanical properties of surfaces, atomic scale synthesis of materials, and enzymatic synthesis of materials.
- The National Center for Electron Microscopy (NCEM) continues to provide forefront research facilities for metallurgy, ceramics, and other materials research. Procurement for an advanced microscope for quantitative atomic resolution and analytical studies is proceeding, and another advanced microscope for studies of magnetic materials is proposed to maintain the nation's research leadership.

Berkeley Lab continues to provide advanced engineering research in instrumentation and magnet technology. Stronger and more-precise magnets are being developed for many research applications based on emerging magnet materials and on composite coil designs.

Berkeley Lab contributes to the magnetic-confinement fusion program through the development of neutral beams for heating and refueling reactor plasmas. Berkeley Lab's work on neutral beams has been coupled with the research efforts to develop an International Thermonuclear Experimental Reactor (ITER).

The Laboratory maintains a training and collaborative research program with Jackson State University (JSU), a historically Black institution, and with the Ana G. Méndez Educational Foundation (AGMEF) in Puerto Rico, a major Hispanic institution of higher education. These cooperative research and training programs are expected to continue at the current level of effort. The Berkeley Lab Center for Science and Engineering Education has increasing numbers of programs for precollege and undergraduate students and faculty.

Energy Efficiency and Renewable Energy

The Berkeley Lab program in Energy Efficiency and Renewable Energy comprises a broad set of related activities that provides research support and technology development for energy conservation and renewable energy use, principally in the buildings and transportation sectors. The emphasis is on long-term laboratory-based research in the physical and chemical sciences. Program areas include energy storage and distribution, geothermal energy research and development, industrial technologies, solar heat technology, energy use and building systems research, transportation, and state and local energy conservation assistance projects.

Office of Fossil Energy

Berkeley Lab conducts research directed toward making coal more usable, including conversion to gaseous and liquid fuels, reduction of emissions, and reservoir characterization. The research ranges from fundamental coal chemistry through laboratory-scale investigations of coal-conversion processes.

Office of Civilian Radioactive Waste Management

Berkeley Lab continues a strong multidisciplinary program of interrelated geoscience and geological engineering research important to the safe, long-term underground storage of high-level nuclear wastes. Research includes characterization of deep geologic formations, determination of the physical and chemical processes occurring between waste-repository materials and the surrounding rocks, analysis of hydrologic and chemical transport mechanisms, and development of predictive techniques for repository performance.

Office of Policy, Planning, and Analysis

Berkeley Lab undertakes analysis activities in support of policy issues of concern to DOE. Recent efforts include analysis of feebates as a policy approach to increase auto fuel economy, combustion pollution exposure that takes place indoors, and assessment of a variety of policies as a response to the DOE mission. In support of DOE's interest in developing a comprehensive understanding of factors that influence the release of "greenhouse" gases, Berkeley Lab is undertaking a series of studies on global energy demand and related issues.

Work for Other DOE Facilities

Berkeley Lab's contributions to research and development programs at other DOE facilities include

- RHIC-STAR detector at Brookhaven National Laboratory.
- Investigations in combustion modeling for Sandia National Laboratories.
- Studies of nucleation scavenging of smoke particles and of laser-material interactions for LLNL.
- Assistance to Oak Ridge National Laboratory (ORNL) in assessing renewable energy applications in developing countries.
- Support of Pacific Northwest Laboratory's efforts to develop energy-consumption standards for residences.

Berkeley Lab's solar-biomass program, supported through ORNL, investigates the cultivation of hydrocarbon-producing plants, such as *Euphorbia*. The program emphasizes crop yield, oil yield, process chemistry, and economics.

In addition, Berkeley Lab is applying its building-energy expertise to Bonneville Power Administration (BPA) programs to develop cost-effective conservation measures and renewable resources that protect the environment while responding to growing demands for electricity.

Work for Others

Other Federal Agencies. Other federal agencies that fund research at Berkeley Lab include the Agency for International Development, the Department of Defense (nonclassified research), the Department of Interior, the Environmental Protection Agency, the National Aeronautics and Space Administration, and the National Institutes of Health.

Other Agencies and Institutions. Other agencies include the Electric Power Research Institute, the Gas Research Institute, the California Association for Research and Development, the California Energy Commission, the California Institute for Energy Efficiency (CIEE), and many private organizations. This work is reviewed by the Laboratory and DOE/SF to ensure that all applicable DOE regulations are satisfied.

PHYSICAL ENVIRONMENT

Topography and Aspect

The Berkeley Lab is situated on the western slope of the Berkeley Hills at an elevation ranging from 150 to 335 meters (490 to 1100 feet) above sea level (Figure 2-1). The site curves along the hills to face mostly west toward San Francisco Bay or south into Strawberry Canyon. The site's aspect has implications for landscaping and potential building color, reflectivity, and glare.

Slopes are steep throughout, constraining building sites and often requiring that roads be circuitous. About 60 percent of the total site has a slope greater than 25% (Figure 2-2) and most of the reasonably buildable slopes have already been utilized for Laboratory structures.

Fig. 2-1. Site topography.

Fig. 2-2. Slopes and stabilization areas.

The hilly terrain has required substantial grading and filling to provide suitable building sites. Fill areas have been deep as well as extensive, measuring several tens of feet thick in some of the original ravines. Most of these fills were mechanically compacted during placement and have been satisfactory for foundation support.

Cuts made in the hillsides to facilitate development have contributed to an inherent slope instability. Over the years, slope stabilization projects have corrected the most serious landslide conditions. Remaining slide areas (Figure 2-2) have been temporarily stabilized and plans have been developed for permanent corrections.

Geology

Most of the Laboratory site is underlain by complex sedimentary and volcanic rock that has been folded and faulted since Cretaceous time. In general, the bedrock has produced a colluvial cover a few feet thick. Natural rock outcrops are few, although there are many rock exposures in cut slopes.

The major geologic unit consists of sandstones, siltstones, claystones, and conglomerates of relatively low strength and hardness. These rock formations are blanketed by clay soils. The western and southern portions of the site are underlain by similar but moderately well-consolidated rock formations. Throughout most of the upper elevation of the site a volcanic unit overlays and is inter-bedded with the upper layers of the major geologic unit.

Landslide deposits have been encountered at numerous geologic locations within the Berkeley Lab site. Over the last 20 years the Laboratory has carried out a program of slope stabilization to reduce the risk of property damage due to both deep and surficial soil movement.

Seismicity

Berkeley Lab is located in a seismically active region (Figure 2-3). The seismically active Hayward Fault, a branch of the San Andreas Fault System, trends northwest-southeast along the base of the hills at the Laboratory's western edge. It has the potential to produce an earthquake of approximately Richter magnitude 7.5. Traces of the Wildcat Fault, also part of the San Andreas System, traverse the Laboratory site, but analysis indicates no evidence that the fault is active in this area.

The San Andreas Fault zone, which has potential for a magnitude 8.3 earthquake, lies about 20 miles west of Berkeley Lab, off-shore beyond the Golden Gate. The Calaveras Fault, another branch of the San Andreas, lies about 15 miles east of Berkeley lab. For an earthquake of any given magnitude, the Hayward Fault would produce the most intense ground shaking at Berkeley Lab because of its proximity.

To reduce the potential for damage from seismic activity, the Laboratory has carried out a comprehensive earthquake safety program since 1971. All new facilities have been designed and constructed to resist the maximum credible earthquake estimated for the site. All existing Berkeley Lab buildings have been reviewed and 34 have been strengthened to meet current risk criteria. Building 90 is currently undergoing seismic strengthening and Building 77 is proposed for FY 1996.

Meteorology

Berkeley Lab has a Mediterranean climate with cool, dry summers and relatively warm, wet winters. The proximity of the Pacific Ocean and the maritime air that flows through the Golden Gate moderate local weather keeping seasonal temperature variations small. The mean summer and winter temperatures are 62°F and 51°F, respectively (Table 2-1). Generally comfortable outdoor conditions prevail throughout the year, although occasional hard freezes can occur in mid-winter.

Relative humidity ranges from 85–90% in the early morning, when ocean fog often affects the site, to 65–75% in the afternoon. Annual insolation ranges from 65 to 75% of that theoretically available, and the average daytime cloudiness is about the same in summer and winter. Heating degree-days number about 2,600 and cooling degree-days about 150. Winds are generally cool and light, less than 10 mph, blowing from the east in the morning and from the west in the afternoon (Table 2-2). In late spring and summer ocean fog often flows across San Francisco Bay to envelope the Berkeley Lab site during morning and evening hours.

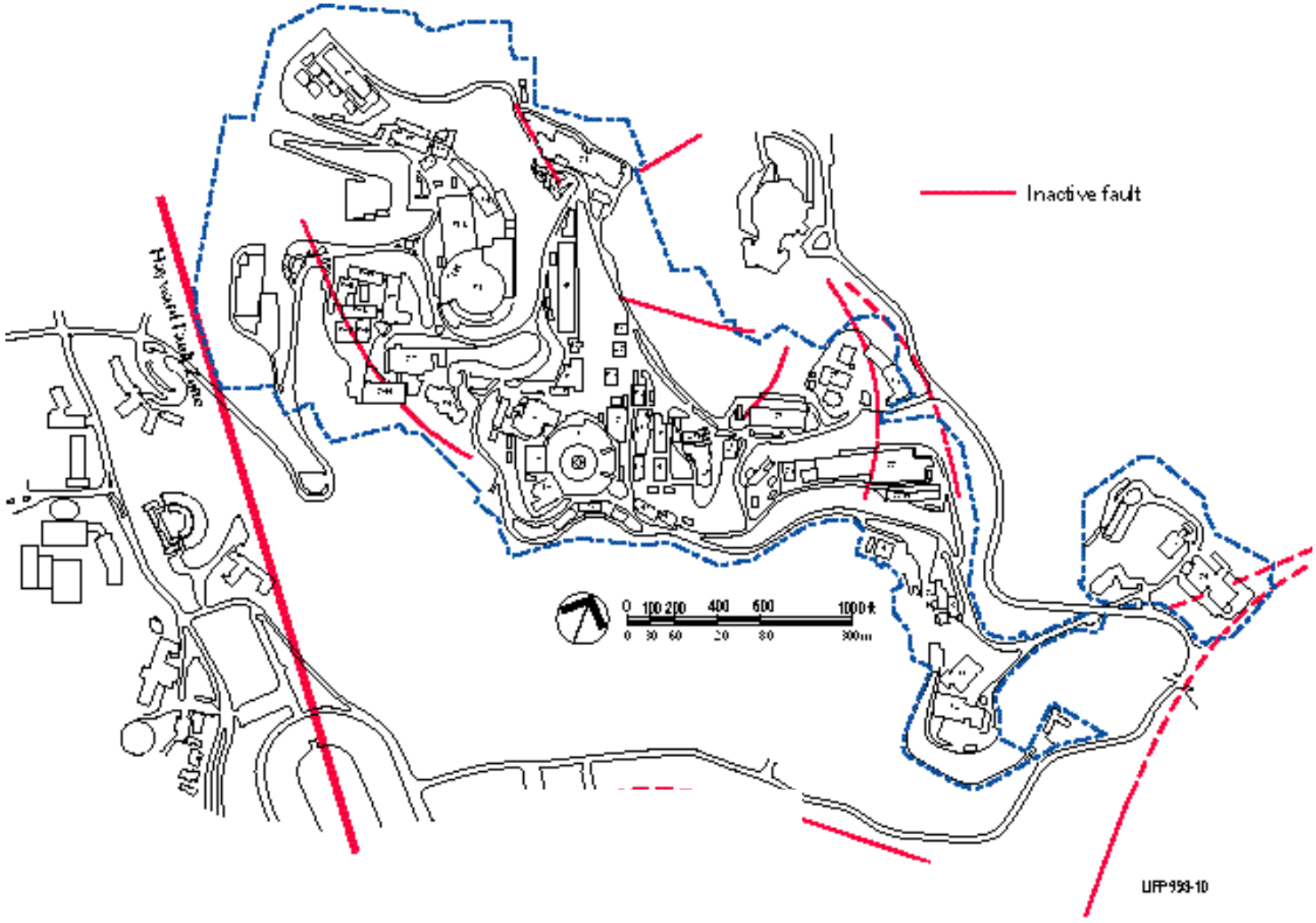


Fig. 2-3. Earthquake faults.

Table 2-1. Berkeley Lab Temperature Normals (°F) by Month.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Max	56.1	59.5	61.1	63.3	66.4	69.2	69.5	69.6	71.7	69.6	62.9	57.0	64.7
Min	43.2	45.8	46.0	47.6	50.3	53.0	53.9	54.7	55.6	52.9	48.3	43.9	49.6
Mean	49.7	52.7	53.6	55.5	58.4	61.1	61.7	62.2	63.7	61.3	55.6	50.4	57.2

Table 2-2. Berkeley Lab Wind Data.

	Speed (MPH)				
Direction	1–3	4–10	11–21	22–27	%
N	0.59	0.97	0.05		1.61
NNE	0.61	0.61	.01		1.23
NE	0.89	1.10	0.20		2.19
ENE	1.10	1.52	.59	0.03	3.24
E	1.97	1.68	0.45	0.03	4.13
ESE	2.46	1.87	0.17		4.50
SE	3.31	3.53	0.39	0.01	7.24
SSE	3.59	4.76	1.13	0.01	9.49
S	3.12	4.44	0.70	0.01	8.27
SSW	3.36	3.86	0.18		7.40
SW	3.24	3.30	0.03		6.57
WSW	3.17	4.28	0.09		7.54
W	4.02	6.45	0.14		10.61
WNW	3.65	4.86	0.26		8.77
NW	3.33	3.19	0.13		6.65
NNW	1.64	2.24	0.08		3.96
CALM					6.60
TOTAL	**40.05**	**48.66**	**4.60**	**0.09**	**100.00**

About 95% of the average annual rainfall of 25 inches at the Laboratory occurs from October through April, the winter rainy season. Rainfall intensities are seldom greater than one-quarter inch per hour (Table 2-3), and thunderstorms, hail, or snow are rare. Drought periods of several years duration are not uncommon, and abnormally wet winters also occur. Overall, however, Berkeley Lab's climate provides generally favorable conditions for comfort control, energy efficiency, and outdoor activities.

Hydrology

Groundwater is a concern for Berkeley Lab because of its potential effect on slope stability. The fractured bedrock underlying the Laboratory allows percolation that augments groundwater. Faults that cut through bedrock tend to drain it, whereas clay layers impede or direct flow. Berkeley Lab's complex geology includes both elements. Across the site water table depths vary from 3 meters (10 feet) to more than 27 meters (90 feet) (Table 2-4).

During the winter rainy season, groundwater levels and hydrostatic pressure increase, intensifying slide dangers. The Laboratory has installed an extensive system of monitoring wells and drainage lines (Figure 2-4) to maintain slope stability.

Table 2-3. Rainfall Intensity and Probability.

Period (yr)	Intensity (in./hr)	24-Hour Duration (in.)
25	0.20	4.30
50	0.22	5.28
100	0.25	6.00

Table 2-4. Water Table Depths.

Functional Area	Depth (ft)[a]
88-Inch Cyclotron Research Area	>40
Central Research and Administration Area	16 – 30
Bevalac Accelerator Complex	18 – 50
Light Source Research and Engineering Area	>20
Shops and Support Facilities Area	65 – 100
Materials and Chemistry Research Area	10 – 15
Life Sciences Research Area	10 – 30

[a]Depths represented as > X indicate existing borings have encountered no free water to that depth.

Because of Berkeley Lab's hillside location, surface runoff is a prevalent feature of the site in the winter rainy season. The Laboratory straddles three divisions of the Strawberry Creek watershed well above any flood plain zone. Various tributaries of the watershed's two main creeks provide natural drainage across the Berkeley Lab site. Within the central portion of the Lab, natural drainages have been engineered to accommodate development and a system of storm drains directs creek flows and collects runoff. To control possible groundwater contamination, the Laboratory's Environmental Health and Safety Department (EH&S) has initiated a program that characterizes and remediates groundwater contaminants.

Existing Berkeley Lab storm drains can accommodate peak water runoff based on a 25-year storm and the intensity-duration data for seasonal rainfall (Table 2-3). Over the last 30 years the drainage system has been improved with large conduits, special inlet and exit structures, energy dissipaters, trash racks, and hardened channels. Successful system operation depends on regular removal of accumulated debris. If the system does become clogged, an emergency bypass system in the Upper Strawberry watershed can be activated.

Vegetation

Most of the major vegetation remaining within the Berkeley Lab site is located around the periphery, away from the centrally developed portion. Since cattle grazing operations ceased in the 1950s, Baccharis brushland has re-established on open slopes and introduced trees have established large stands. Without recurrent wildfires or other management intervention, open areas of the site will continue to transition to an oak-bay woodland.

Vegetation on the Laboratory site can be broadly categorized into four types (Figure 2-5). Native Woodland, Eucalyptus Plantations, a Hillside Habitat of grasses and brush, and Mixed Introduced Species which include ornamental plantings near buildings. Only the remnant stands of Oak-Bay Woodland consist of species native to the site. The most common and widespread vegetation types on the Laboratory site are the Hillside Habitat and the Eucalyptus Plantations. The open grassy slopes of the Hillside Habitat occur primarily in the eastern portion of the Lab while the western portion of the site is more forested.

Native Woodland. A mix of coast live oak (*Quercus agrifolia*) and California bay (*Umbellularia californica*) that occurs naturally in ravines and drainages which retain some moisture during the long dry season. The understory can be quite open under the spreading canopies or dense with tangled underbrush. The trees grow relatively slowly, reaching a height of up to 15 m (50 feet) in about 25 years.

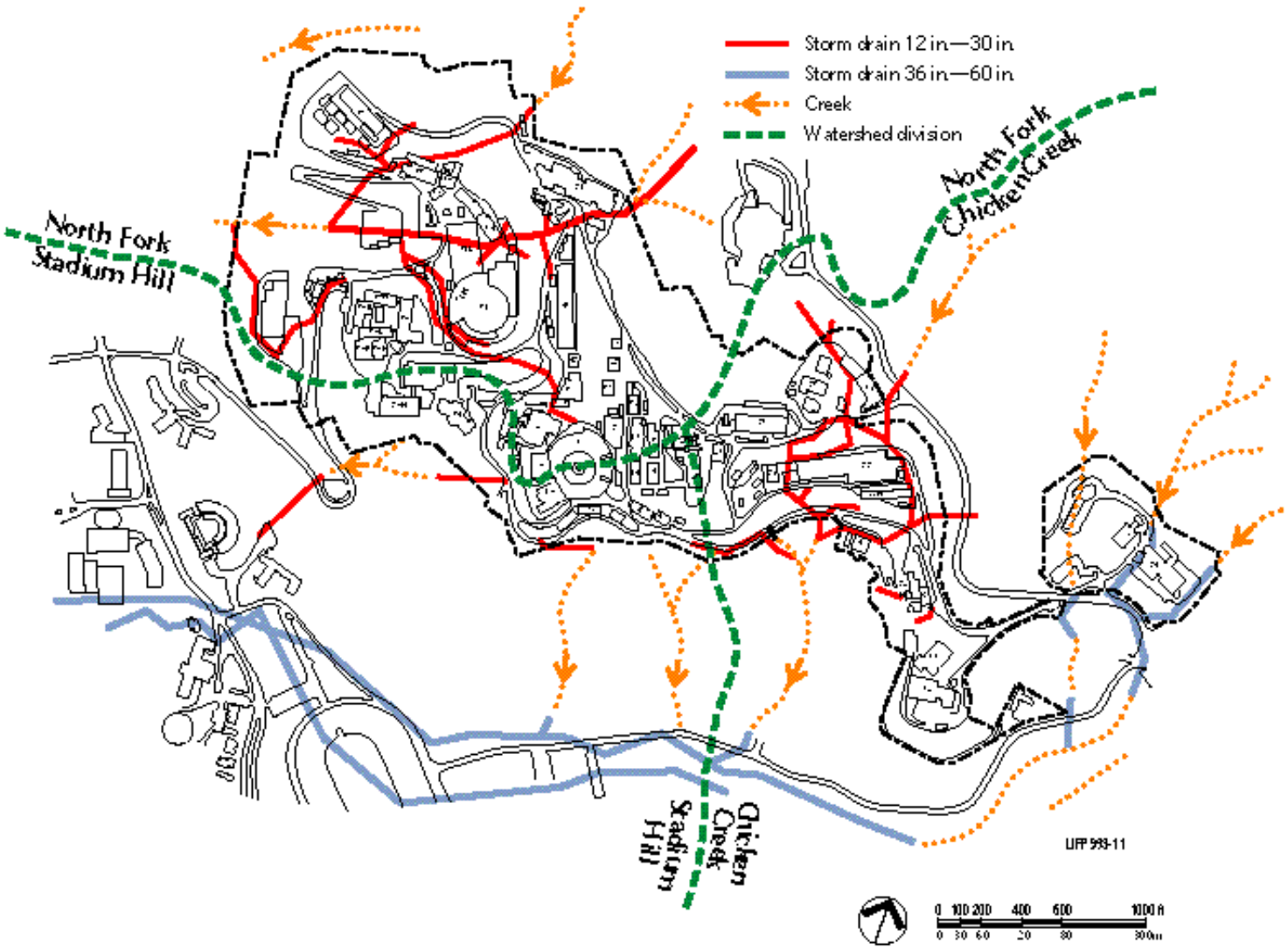


Fig. 2-4. Hydrology and storm drainage.

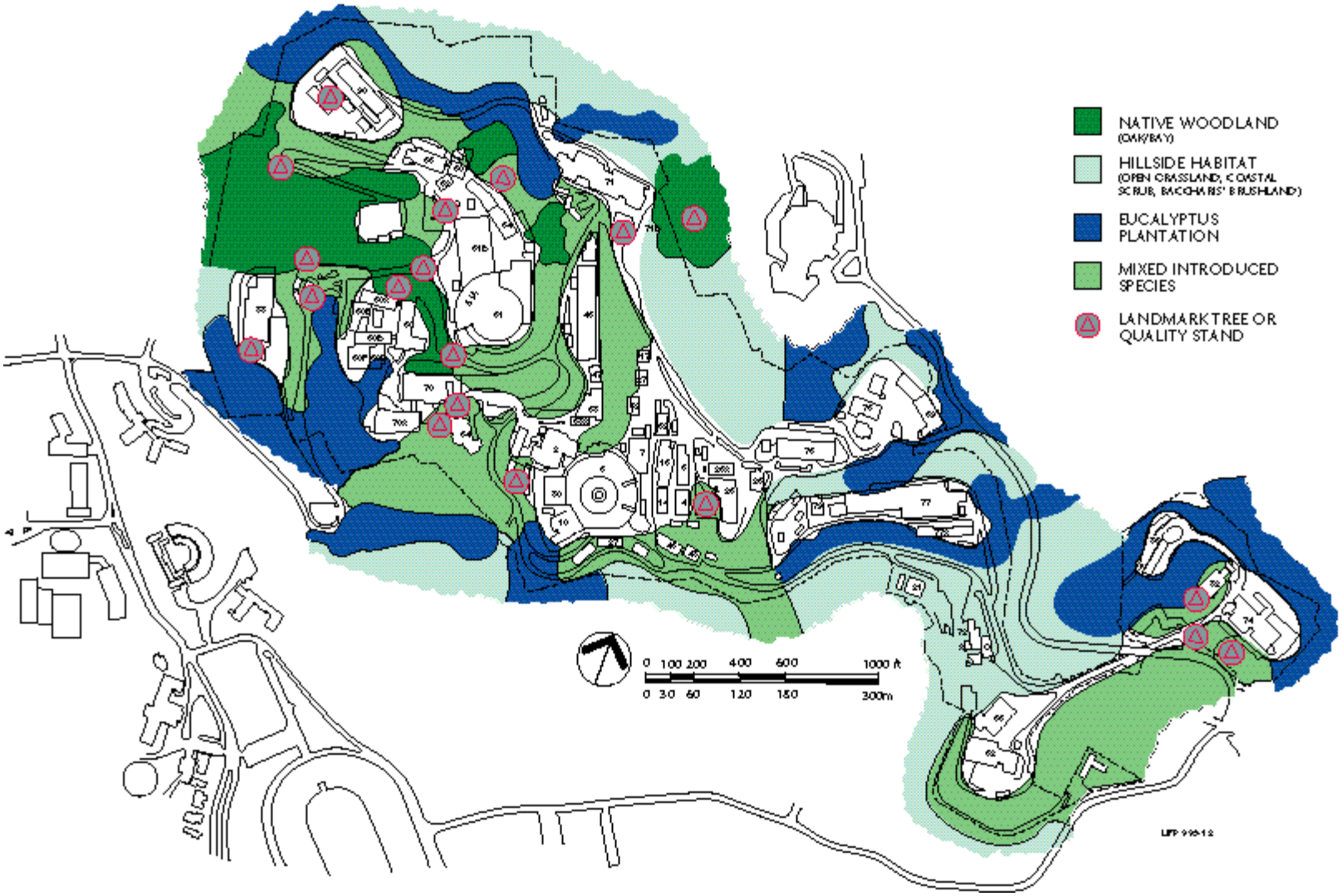


Fig. 2-5. Vegetation types.

Eucalyptus Plantations. The Berkeley Hills have been widely planted with introduced eucalypts, primarily *Eucalyptus globulus*, the blue gum eucalyptus. The Laboratory has extensive stands of this tree both on the site and surrounding its borders. Several other Eucalyptus species also occur on the Laboratory singularly or in small clusters. The blue gum eucalyptus grows vigorously and tall, easily reaching a height of 24 to 30 meters (80 to 100 feet). Fruit drop, leaf debris, and large pieces of exfoliated bark from the trees present maintenance and fire management concerns, although eucalyptus stands usually have an open understory.

Hillside Habitat. Several types of grassy, brushy vegetation share the open slopes on and around the Lab. Coyote brush (*Baccharis pilularis*) occurs in sporadic clumps until it spreads sufficiently to form a dense shrub mass about two meters tall (six feet). Coastal scrub areas on south- and west-facing slopes host sparse, low shrubs (up to 1 meter or three feet tall) dominated by California sagebrush (*Artemisia californica*). Introduced annual grasses have naturalized in open areas and on most disturbed sites. The major grass species present are soft chess (*Bromus mollis*), wild oats (*Avena* spp.), and wild barley (*Hordeum* spp.) Low broad-leaved plants commonly associated with annual grassland include rabbit-foot clover (*Trifolium arvense*), cut-leaved geranium (*Geranium dissectum*), and English plantain (*Plantago lanceolata*). Recent hydroseeding operations to control surficial erosion have used native grass seeds (*Stipa pulchra* and *Stipa sernua*) for their deep rooting and drought resistant characteristics.

Mixed Introduced Species. Introduced species include trees native to the State, but not naturally occurring on the site, such as Monterey pine (*Pinus radiata*), knobcone pine (*Pinus attenuata*), Canary Island Pine (*Pinus canariensis*) and coast redwood (*Sequoia sempervirens*). The conifers are fast growing trees with generally sparse understory.

A variety of other introduced ornamental species of trees, shrubs, and perennials have been planted around existing facilities. Many are not Mediterranean-type species and so have not evolved to handle a long annual dry season. These introduced species require regular supplemental irrigation to maintain health and appearance.

Wildlife

In general, the Laboratory site supports habitats and associated wildlife that are typical of disturbed portions of the Berkeley-Oakland hills. Approximately 79 species of birds, 20 mammal species, and 19 reptile and amphibian species, none rare or endangered, occur on or near the site.

The most significant wildlife habitats at Berkeley Lab (Figure 2-6) occur in Blackberry Canyon and to a lesser degree at the northeasterly edge of Functional Planning Area 7. The lower portion of Blackberry Canyon supports a relatively intact oak-bay woodland, but is completely surrounded by development, so the habitat is small and limited. The East Canyon area is rated as important because of the high interspersion of habitats and the proximity of adjacent undeveloped lands.

The Baccharis brushland at Berkeley Lab provides cover, food, and breeding sites for a variety of common birds and mammals of the region, the dominant mammals of which are brush rabbits and mule deer. The Laboratory's tree stands offer nesting sites for many bird species and, during the flowering season, the eucalyptus provide food for nectar-eating birds. In general, the sparse tree understory offers poor wildlife habitat.

Landscape Management

Landscape Buffers. To facilitate appropriate siting of buildings and protect important open space areas, the CFP has established nine landscape buffer zones across the site (Table 2-5 and Figure 2-6). The Laboratory manages these landscape buffers for a variety of functions:

- Site amenity for employees and visitors
- Scale and context for Laboratory development
- Separation of adjacent uses, internal and external

Fig. 2-6. Landscape management.

Table 2-5. Landscape Buffer Zones.

	Planning & Protection Criteria				Special Considerations
	Views or Exposure	Building Density	Hydrology & Stability	Vegetation	
A Central Blackberry Canyon			•	•	Forested area with creek
B West Strawberry Canyon	•			•	Bayview; eucalyptus, dawn redwoods, and cork oaks
C Light Source Area	•	•		•	Sequoia redwoods, building density
D East Strawberry Canyon	•	•		•	Dawn redwoods, other evergreens
E Life Sciences Area	•			•	Forested area; evergreen and eucalyptus
F Grizzly Gate Perimeter	•		•		Slope stability
G Northeast Perimeter	•		•		Stability, drainage, and exposure
H Bevalac Perimeter	•	•	•	•	Slope stability; evergreen trees
I North Blackberry Canyon	•			•	Exposure, eucalyptus trees

- Visual and sound screening, internal and external
- Microclimate modification
- Erosion control
- Wildlife corridors and habitat

Of special importance is the capacity of the landscape buffers to blend the developed Berkeley Lab campus with the surrounding hillside context. Except on the western edge, perimeter landscape buffers merge with adjacent open space beyond the Berkeley Lab fence line.

Erosion Control. The steepness of the Laboratory site makes protection from wind and water erosion a serious concern. Vegetation provides the best control of surficial erosion by reducing the impact of rain on soil, while plant roots stabilize and hold topsoil. In 1992 Berkeley Lab developed a hydroseed project to revegetate bare soil areas on the Laboratory site. The seeding operation depends on winter rains sufficient to produce germination without washing the seed away. Variable weather can require repeated applications for success.

Berkeley Lab has also uses other means to control surficial erosion including retaining walls, slope terracing, and paving of footpaths.

Fire Management. Within the Berkeley Lab fence line most of the Laboratory's north perimeter is managed as a fuel or fire break. Fire protection along the south and east perimeters is complicated by limited buffer space within the

fence line and concomitant proximity to less-managed University lands. Since the fire of October 1991 which devastated the adjacent Berkeley/Oakland Hills, Berkeley Lab has updated and intensified its fire management efforts.

The primary objective of the renewed effort remains to reduce and control fire hazards in the outdoor areas of the Laboratory. The basic strategy involves reducing fuel loads and fire "laddering" capabilities. The Laboratory's Fire Inspector and Consulting Landscape Architect coordinated the effort to reduce fire hazard while maintaining landscape value. Priority fuel management measures (see Figure 2-6), including revegetation with native species, were completed in the fall of 1992 and next steps are underway.

A management and reforestation plan is currently being developed in order to assure long term continuity in Berkeley Lab's landscape value. Both inappropriate species and declining trees need replacement and the Laboratory would benefit from increased tree cover in several areas.

Visibility

Berkeley Lab occupies a highly visible and sensitive hillside in an urban setting (Figure 2-7). Berkeley Lab's landscape buffers support extensive tree cover which creates a pattern of foliage across the most visible western face of the Lab. The dominant tree types are fast-growing evergreens planted on the steep slopes below relatively low profile Berkeley Lab buildings. In combination with the elevational differences between Berkeley Lab buildings, the tree plantations create tall screens that both separate buildings and hide most of them from urban and campus views below. The western forestation also provides an appropriate setting of tree canopies for the distinctive dome of the original cyclotron, a regional landmark.

When viewed from urban areas below and west of Berkeley Lab, the most prominent buildings on the hillside are the Lawrence Hall of Science and other University buildings above the Laboratory site. Lower on the hillside, portions of several major Laboratory buildings can be seen. Painted in earth-tone colors, the Berkeley Lab buildings blend with their hillside context and are partially screened by tall trees so that most of the Laboratory is not visible.

The eastern portion of the Laboratory has less forestation to provide screening. From UC's Memorial Stadium the buildings of Planning Area 6 are highly visible. Public views into the Lab site occur along Centennial Drive and from the Lawrence Hall of Science above. Views from higher elevation residences and the Lawrence Hall of Science see directly into 'back' areas of the Laboratory. From these high vantages the bands of internal landscape buffers provide the only possible screening and softening of industrial-looking Laboratory areas. While screening views from above is very difficult, additional tree planting will eventually reduce Laboratory visibility from Centennial Drive.

Historical Resources

No prehistoric cultural resources have been identified within the Berkeley Lab fence line. In 1987 a historical evaluation considered the original cyclotron building (Building 6) a "highly significant landmark" marking an important episode in scientific research and the development of the UC Berkeley campus. The report concluded that internal and external building changes could be made if the original visual quality of the building is sustained. Reuse of the structure for the Advanced Light Source (ALS) has followed the report's guidelines for modifications and retained the building's original visual character.

UTILITIES

The Laboratory's operations require a complex of utility systems. Utility lines are underground except for the aerial 115 kV electrical power line. The Laboratory does not prescribe easements for the various utility lines. It does cluster lines for ease of access, and some areas have been formally designated as utility corridors. Efforts are underway to transfer manual mapping of the utilities to a computerized system.

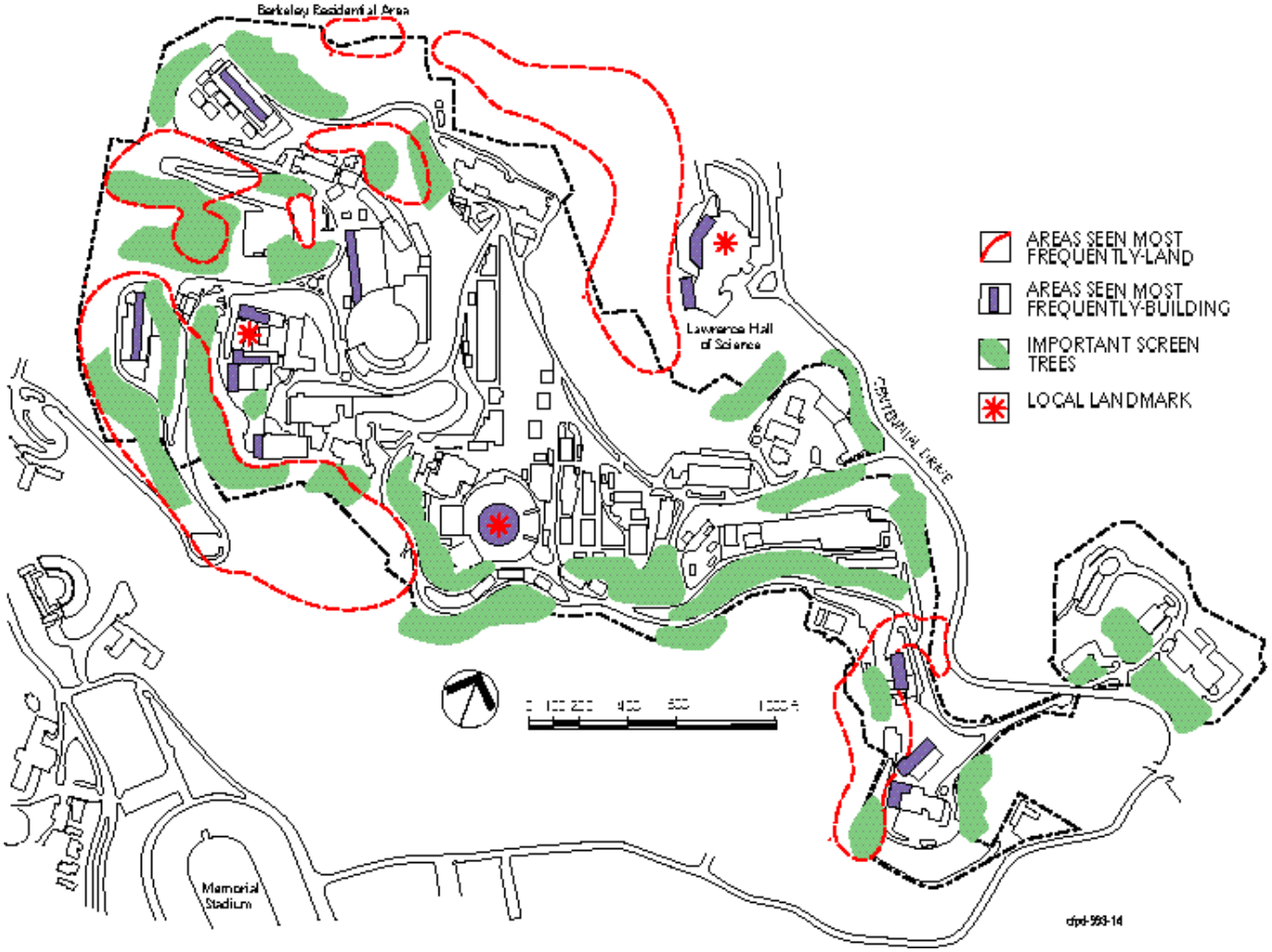


Fig. 2-7. Visibility from community below.

Water System

The Laboratory's water is supplied continuously from two sources. The primary water supply is the East Bay Municipal Utilities District (EBMUD) Shasta Reservoir. The Laboratory's high-pressure fire and domestic system is supplied from this reservoir. A secondary source is EBMUD's Berkeley View tank, with a capacity of approximately 11,350 m^3 (3.0 million gallons), connected to Berkeley Lab by EBMUD piping.

The Berkeley Lab water distribution system contains several backup safety distribution loops and is valved to provide control in case of emergency. The system normally operates by gravity flow, requiring no pumps or energy consumption for operation within the Laboratory (Table 2-6 and Figure 2-8). The Laboratory has two 750-m^3 (200,000-gallon) fire-protection storage tanks. One is located near Building 75 in the Shops and Support Facilities Area and the other near Building 71 in the Bevalac Accelerator Complex. Automatically starting diesel-powered pumps will maintain a reliable flow for the fire-protection system during emergencies. Two auto shutoff valves are associated with the storage tanks. They are there to keep the fire pumps from emptying the tanks on the ground if there is a major break.

Table 2-6. Site Mechanical Utilities—Water Distribution System.

Functional Area	Existing			Additions Planned
	Length (ft)	Utilization (%)	Life (yr)	
88-Inch Cyclotron Research Area	1260	50	25+	No
Central Research and Administration Area	7405	50	25+	Yes
Bevalac Accelerator Complex	7060	50	25+	No
Light Source Research and Engineering Area	5360	50	25+	Yes
Shops and Support Facilities Area	9430	50	25+	Yes
Material and Chemistry Research Area	2650	50	25+	Yes
Life Sciences Research Area	1460	50	25+	Yes

Improvements to the water system are required, and Phase I of a mechanical utilities rehabilitation project, which has been completed, addressed the most-critical needs. Chapter 3 provides an analysis of utility systems; Chapter 4 describes funded and proposed utility improvement projects.

Sanitary Sewer System

The western portion of Berkeley Lab's sanitary sewer system (Table 2-7 and Figure 2-9) connects to the City of Berkeley sewer main in Hearst Avenue. On the south side of the Laboratory, a second connection is made to the City of Berkeley system on Centennial Drive. The Laboratory monitors its discharges for the presence of certain chemicals and radioactivity.

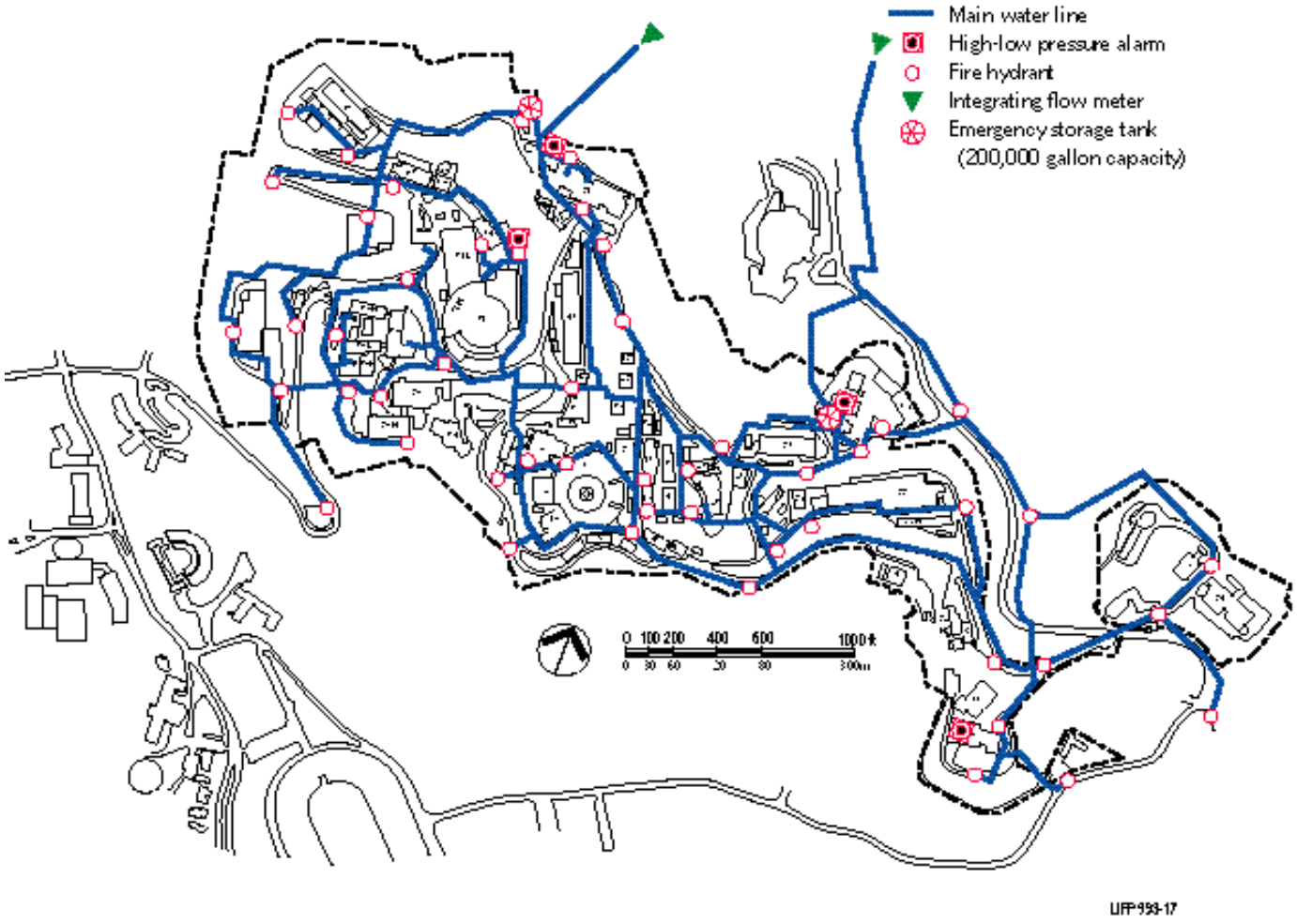


Fig. 2-8. Water distribution system.

Table 2-7. Site Mechanical Utilities—Sanitary Sewer System.

Functional Area	Existing			Additions Planned
	Length (ft)	Utilization (%)	Life (yr)	
88-Inch Cyclotron Research Area	880	50	25+	No
Central Research and Administration Area	4580	50	15-25+	Yes
Bevalac Accelerator Complex	3715	50	15-25+	No
Light Source Research and Engineering Area	2990	50	15-25+	Yes
Shops and Support Facilities Area	4330	50	15-25+	No
Material and Chemistry Research Area	1100	50	15-25+	No
Life Sciences Research Area	790	50	15-25+	Yes

Natural Gas System

Natural gas transmission service to Berkeley Lab is supplied by the Pacific Gas and Electric Company (PG&E) (Table 2-8 and Figure 2-10). A 6-in. main in Hearst Avenue feeds the PG&E-owned meter station at the entry to the Berkeley Lab site. Chapter 3 analyzes the condition of this system, and Chapters 4 and 5 describe plans for systematic replacement of aged and/or deteriorated components.

The Hearst Avenue meter station contains one meter for gas supplied at an interruptible rate. PG&E main pressure is about 40 psi, which is reduced to 13 psi at the Hearst Avenue meter station.

The 13-psi distribution pressure is further reduced at various regulator stations to serve either a group of buildings or in some cases a single building. Building pressure is in the range of 0.25 to 1.25 psi. Earthquake shutoff valves have been installed at the entrance main and outside major buildings to reduce the possibility of explosions following a quake. The natural gas is principally used for space and water heating; there is no central heating plant at Berkeley Lab.

Electrical Power System

Electrical power at the Laboratory is distributed underground at 12 kV from the centrally-located Grizzly main substation (Table 2-9 and Figure 2-11). Smaller substations to supply power at 480/277 V or 208/120 V are located at individual buildings or building clusters.

The PG&E supply system consists of two overhead 115-kV, 3-phase, 60-Hz transmission lines with a joint capacity of approximately 100 MW. Both transmission lines feed power from PG&E's Sobrante switching station to the Berkeley Lab Grizzly main substation.

The 12-kV distribution circuits are arranged in radial and loop-feed configuration using oil- and gas-filled sectionalizing switches.

Long- and short-term improvements to both mechanical and electrical utilities are identified in Chapters 4 and 5, respectively.

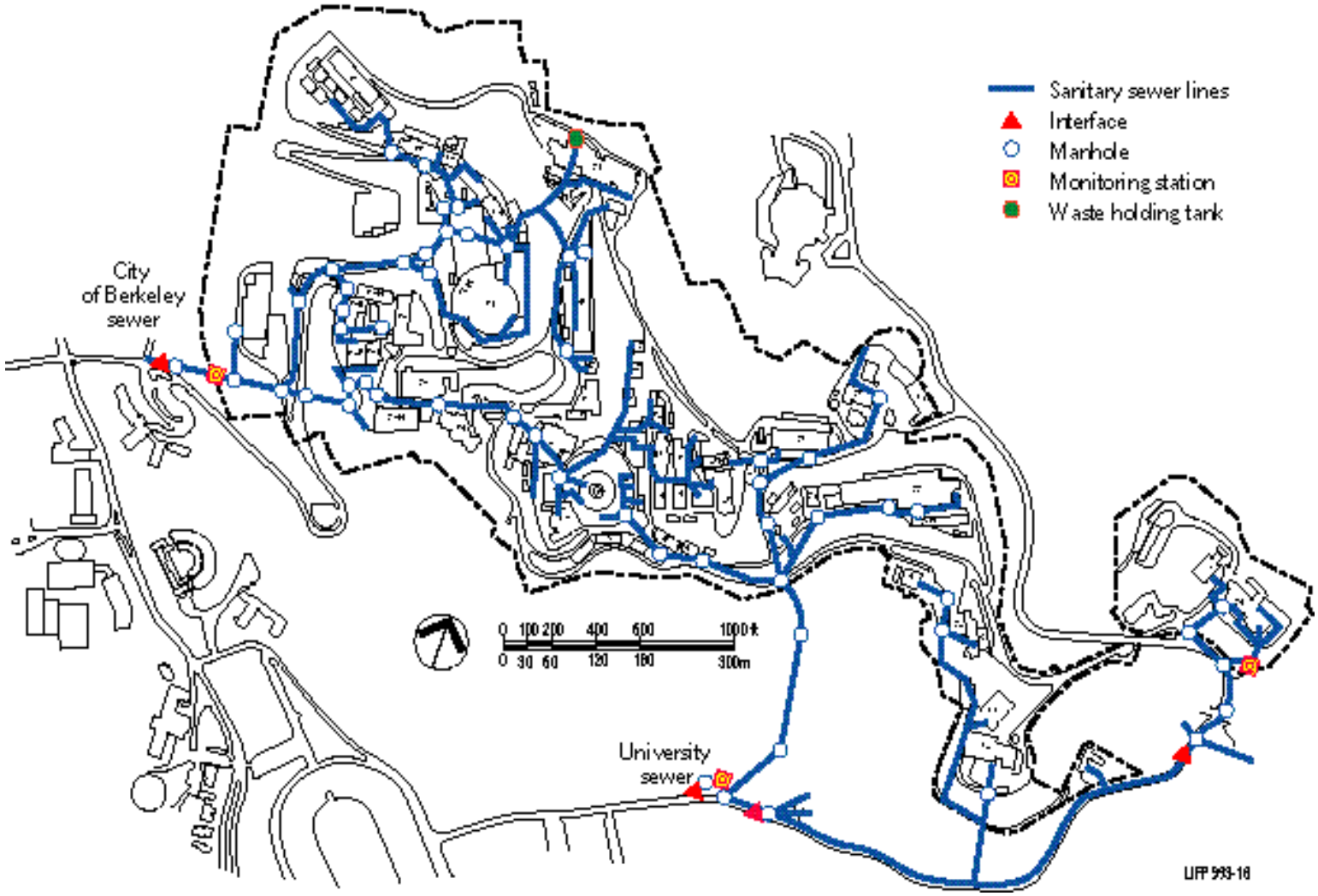


Fig. 2-9. Sanitary sewer system.

Table 2-8. Site Mechanical Utilities—Natural Gas Distribution System.

Functional Area	Existing			Additions Planned
	Length (ft)	Utilization (%)	Life (yr)	
88-Inch Cyclotron Research Area	970	50	10+	0
Central Research and Administration Area	4770	50	10-25+	750
Bevalac Accelerator Complex	1940	50	25+	550
Light Source Research and Engineering Area	1740	50	25+	1150
Shops and Support Facilities Area	2925	50	25+	1000
Material and Chemistry Research Area	1320	50	25+	800
Life Sciences Research Area	1655	50	25+	1300

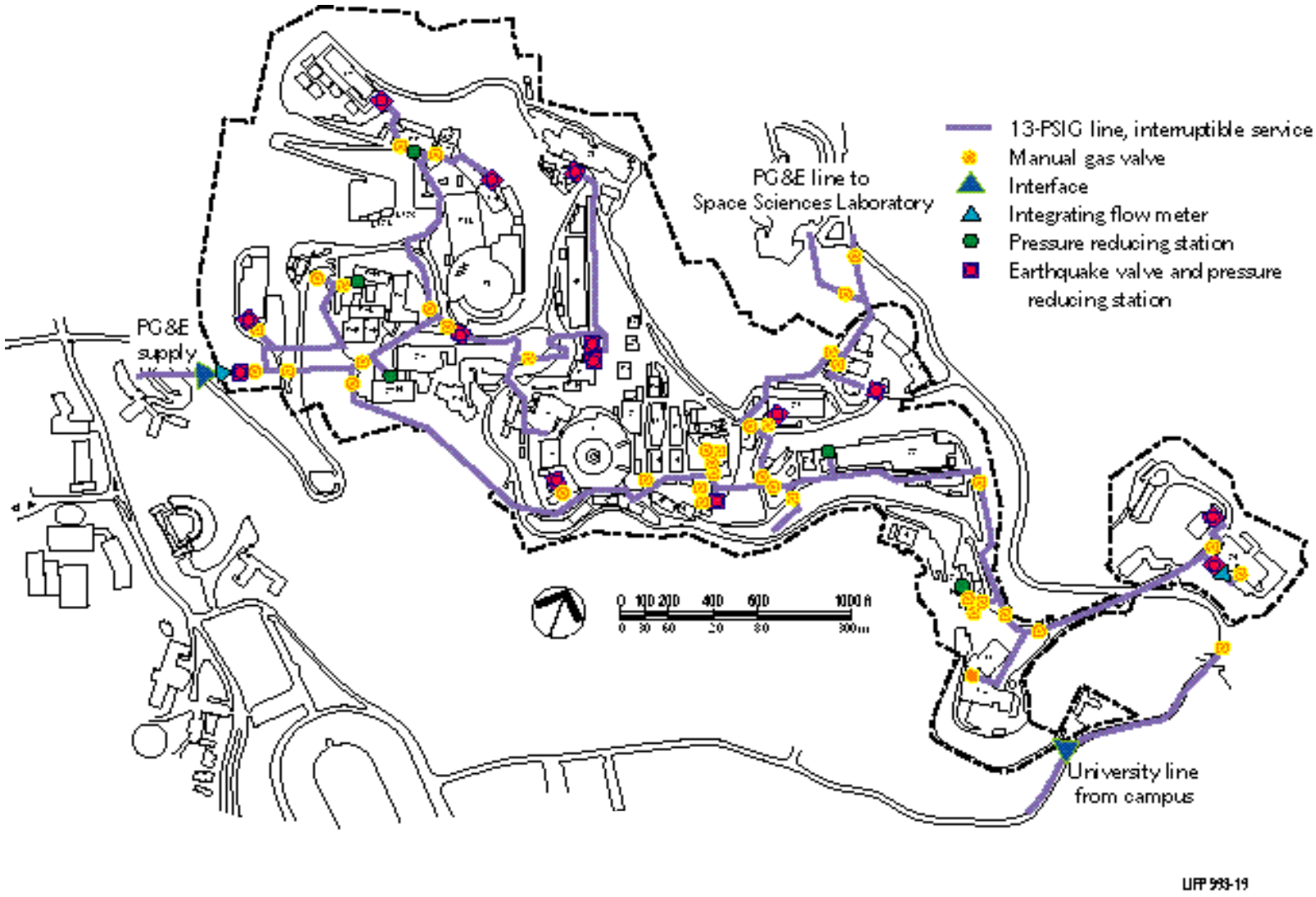


Fig. 2-10. Natural gas system.

Table 2-9. Site Electrical Utilities.

Functional Area	Condition	Utilization	Remaining Life
88-Inch Cyclotron Research Area	Poor	Adequate	None
Central Research and Administration Area	Poor	Adequate	None
Bevalac Accelerator Complex	Poor	Adequate	None
Light Source Research and Engineering Area	Poo4 – Excel[a]	Adequate	5–20 years[a]
Shops and Support Facilities Area	Poor	Adequate	None
Material and Chemistry Research Area	Poor[b]	Adequate	None
Life Sciences Research Area	Poor[b]	Adequate	None

[a]ALS 12-kV Power System. The remaining rehabilitation of this area's 12-kV power system is in progress.
[b]The rehabilitation of this area's 12-kV power system is in progress.

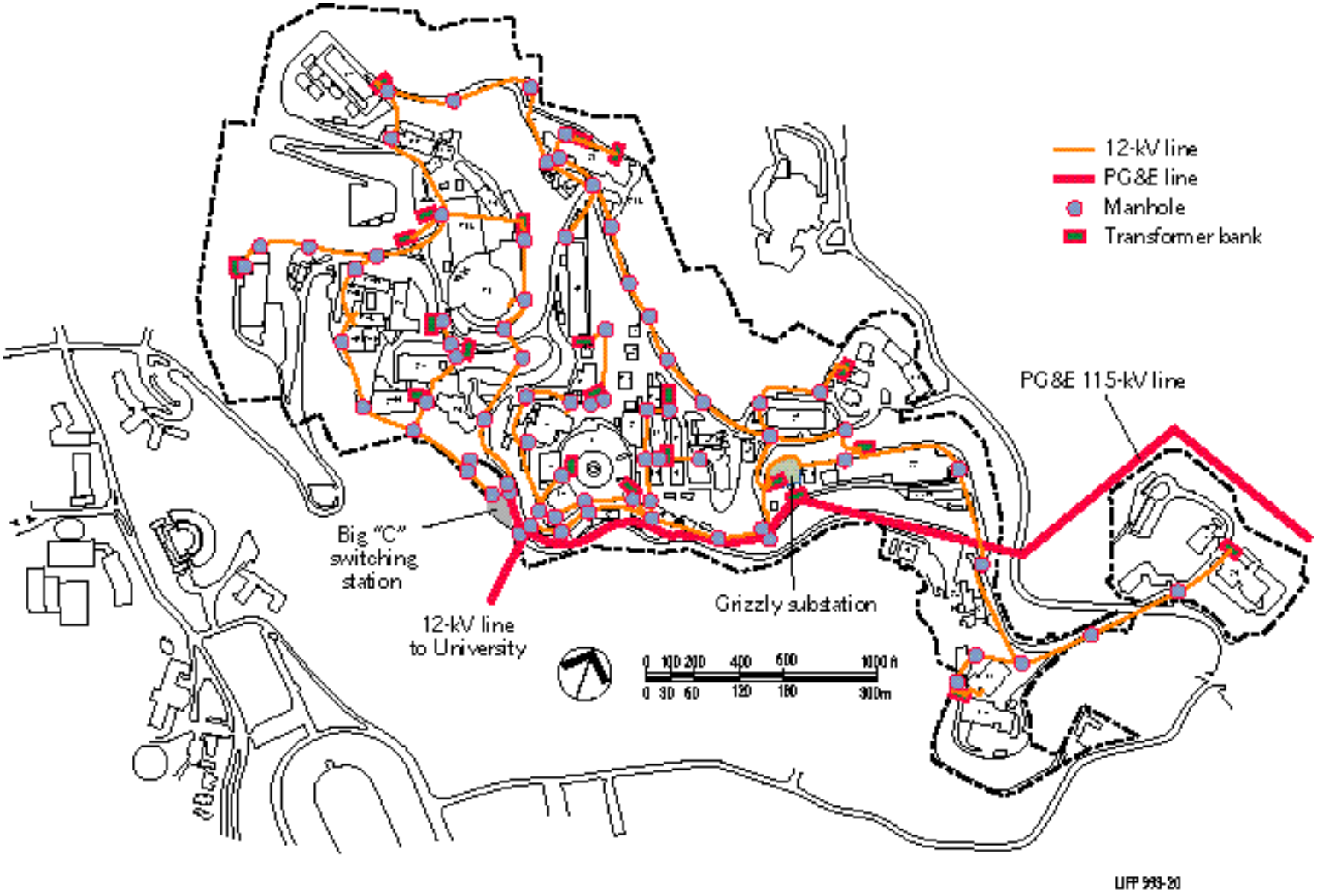


Fig. 2-11. Electrical system.

COMMUNICATIONS

Telephone System

The Laboratory owns and operates an Integrated Communications System (ICS) that provides both telephone and switched data services. The ICS includes an extensive system of underground ducts (Figure 2-12), manholes, copper and fiber-optic cables, building entries, distribution closets, and wiring. The underground duct system was significantly expanded as part of the ICS installation project, which also included installation of an entirely new cable and wire plant. Although it is generally adequate, certain portions of the conduit system are inadequately sized to accommodate anticipated growth. Upgrade projects for these are proposed. Berkeley Lab underground ducts also contain the now unused Pacific Bell cables, which can be removed, as necessary, to free space in the ducts. The ICS is based on an InteCom IBX S/80 digital switch that provides switched voice and data services and trunks to external networks, including Pacific Bell (the local telephone company), AT&T, and the Federal Telecommunications System (FTS 2000). The ICS supports a voice system that currently serves 4,500 stations, with a capacity of 7,500 voice lines.

Computer Network

LBLnet is a Laboratory-wide computer network comprising underground fiber-optic cables, coaxial and wire systems in buildings, and active components in buildings. LBLnet is connected through gateways to external networks, including HEPnet, NSFnet, BARRNet, ESnet, and the UCB Campus network. LBLnet currently supports more than 3,000 attached computers, workstations, and printers using various networking protocol suites, including the Internet, DECnet, and Xerox Network Services and IPX protocols.

Videoconferencing

Berkeley Lab participates in the successful Energy Resources Videoconferencing Network (ERVN) project, which originally linked Berkeley Lab, FNAL, SSCL and several universities using ESnet communications bandwidth. Now ERVN has a central dialup hub at LLNL that supports 17 DOE and university sites. Berkeley Lab is adding communications facilities that will allow any Berkeley Lab videoconference room to place direct-dial video calls anywhere within reach of the FTS 2000 network. Initial service will include the videoconference rooms in Building 50F and in Building 50B room 4205. Additional videoconference rooms can be added at any Berkeley Lab location.

Radio, Television, and Wide-Band Communications

The Laboratory has radio and wide-band communications systems operating on eight VHF channels and on two microwave channels. There are over 500 fixed and portable radio units operating to serve off-site and on-site transportation, a repeater link to LLNL, the University Police Department, the Fire Department, Crafts and Maintenance forces, individual radio paging, and the Director's Office and Building Managers Emergency Command Center. The obsolete microwave data link to SLAC was shut down recently. The remaining 7 GHz link provides full motion video from the SLAC conference room to Berkeley Lab conference rooms at Building 70 room 263 and Building 50B room 6208. A 23-GHz microwave link was installed to provide telephone and LBLnet service to the Promenade Building 938. A 2.73 mile 23 GHz link is being installed to the Dymo Building 934. A television surveillance system is also used in computer rooms and high-radiation areas and for other security needs.

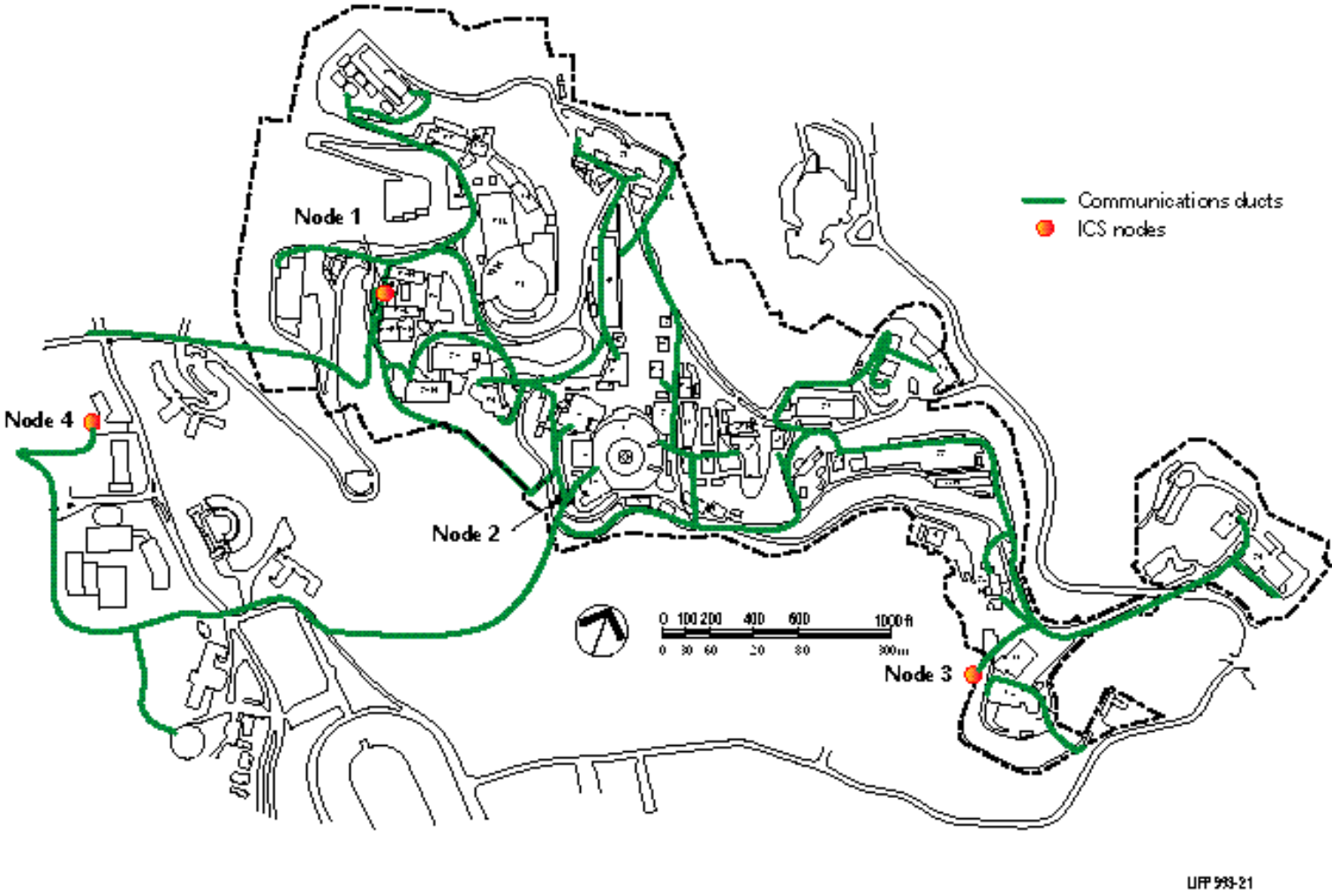


Fig. 2-12. Integrated Communications System.

Public-Address System

A Laboratory-owned public address system links the entire Berkeley Lab area, providing paging for Laboratory-wide announcements related primarily to health, safety, and emergency situations. This system is expanded to each newly constructed building and facility through rigid conduits in underground raceways installed at the time of construction.

SECURITY SYSTEMS

Fire Alarm System

The Berkeley Lab fire alarm system completed in 1985 uses solid-state programmable equipment and two main looped trunk lines with redundant paths. The looped trunk lines feed alarm information to the central supervising station in the Fire Station. A drop from a main trunk loop serves each building. Both Loop #1 and Loop #2 serve the entire Laboratory area. The Berkeley Lab-occupied buildings on the UCB campus are served by an isolated trunk from the Fire Station and by the UCB campus fire alarm system. The Fire Station console consists of a prioritized CRT alarm display, logging printer, a backup annunciator system, and a computer-aided dispatch system. The multialarm system monitors 1,650 points.

All major buildings and most minor buildings have local alarm (bell) evacuation systems. High-value areas have special protection systems with ionization-type smoke detectors as the primary detection means. Improvement of bell systems and smoke detection in several buildings is planned.

Plant Protection Card-Key System

A magnetic card-key system monitors entry into Laboratory buildings and limits access to rooms or areas for reasons of security, health or safety. The card-key system is operated by the University Police Department using a dedicated computer that identifies the user and then records and controls access.

LAND USE

Steep topography has dictated compact development of the Berkeley Lab's 54 hectare (134 acre) site. About 20 hectares (50 acres) have been developed with buildings, roads, parking, and other improvements. Another hectares (11 acres) in the eastern end of the site are reserved for future development. Because of important features and physical constraints, the remaining 32.5 hectares (80 acres) of the Laboratory site are designated as open space or landscape buffers. The compact development of the Laboratory promotes a close-knit research community and interaction among support services and scientific program staff.

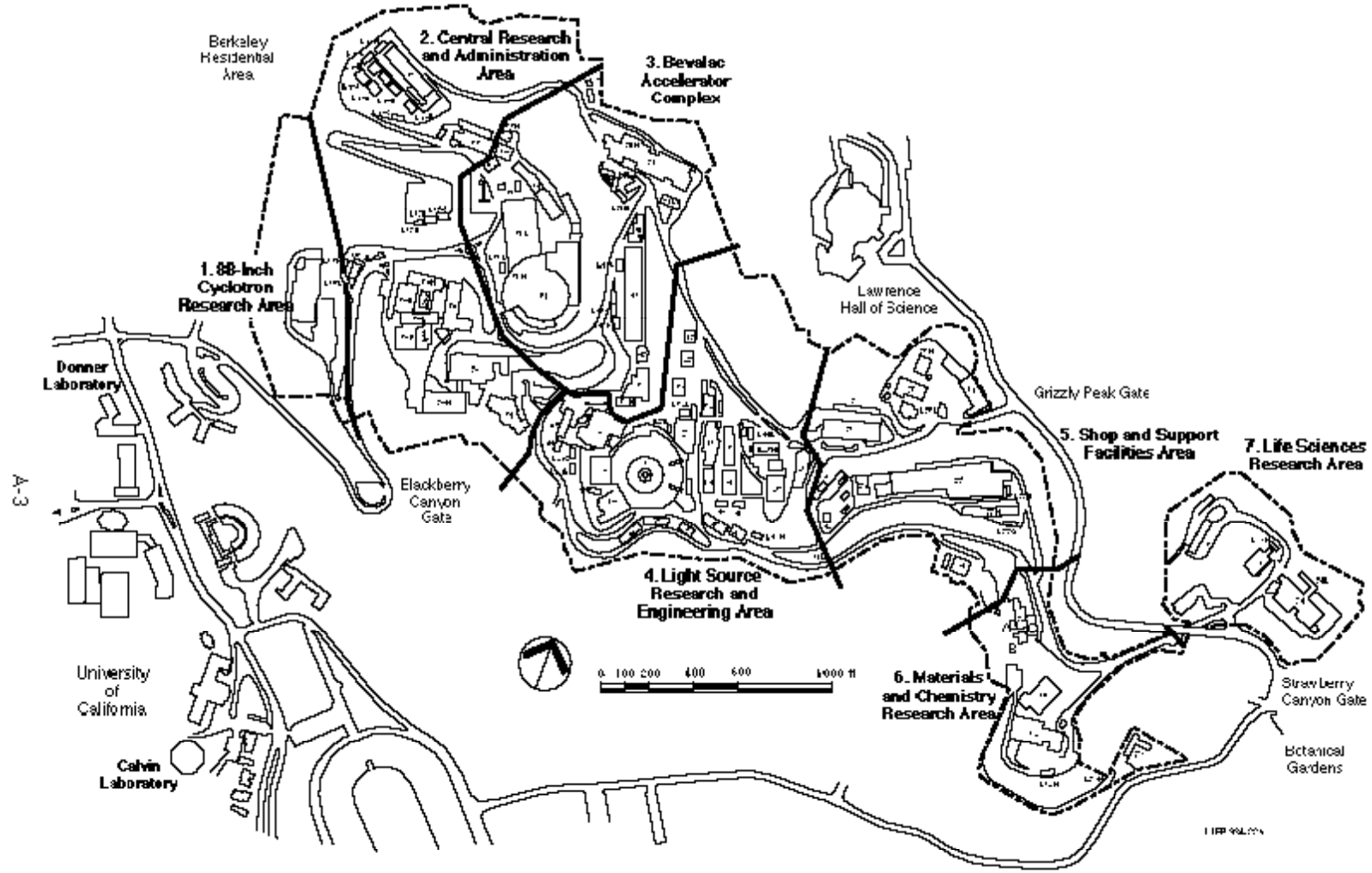
Functional Planning Areas

For efficiency and planning, the Laboratory groups related facilities and activities into seven functional planning areas (Figure 2-13). In concept, each core area is composed of a cluster of buildings whose perimeter provides traffic and service access, parking, and a landscape buffer.

Open Space

Among other functions, the Laboratory's open space buffers activities from adjacent uses both on and off the site. A series of internal landscape buffers separate many of the functional planning areas from one another, providing visual screening, noise reduction, and site amenity. Perimeter open space merges with adjacent off-site open space to provide a buffer between the Laboratory and nearby residential and University uses.

To facilitate the appropriate siting of buildings, the CFP has divided the Laboratory open space into nine sensitivity zones. These zones protect valuable vegetation, preserve important scenic vistas of the Bay, avoid unsightly exposures that face the city or UCB campus, or respect significant geologic and hydrologic limitations (Figure 2-6). Table 2-5 identifies the sensitivity zones and notes special elements of concern within each.



A-3

Fig. 2-13. Functional planning areas.

Social/Recreational

'People places' are an important part of Laboratory life for visitors and employees. The steep site offers the incomparable amenity of numerous views west to San Francisco Bay and the area's cities, hills, and bridges. Several buildings and outdoor places provide exceptional vistas.

The steep site cannot easily accommodate large recreation spaces, but employees at several locations have initiated sports opportunities in the form of basketball hoops (3), volleyball (1) and archery (2, since abandoned). Joggers, walkers, and bicyclists use the roads for lunchtime and after work exercise. Berkeley Lab does not provide recreational facilities for its employees, but showers are available in some buildings.

Overall, the Laboratory currently lacks any sizable outdoor gathering space and has few attractive smaller ones. The Laboratory allows opportunities for small-scale social and passive recreational activities (Figure 2-14) with a variety of informal picnic tables funded by interested employees. Newer buildings such as the Advanced Materials Laboratory provide small terraces for outdoor use. A number of outdoor places such as 'Seaborg Glen' offer special and appealing qualities appropriate for 'people places'. Relatively minor improvements to most of the site's outdoor use areas will support usage and provide an attractive amenity for employees and visitors. The Landscape Master Plan has identified additional areas that should be developed for outdoor use (see Chapter 4, Figure 4-3) including a perimeter trail useful for exercise and site linkage.

Circulation

Berkeley Lab's roads and walkways provide for movement of personnel and materials. In older areas of the Laboratory the circulation system is substandard, with narrow, indirect, and confusing access. Roadway improvement projects will physically improve circulation routes and redevelopment of older areas will eventually allow route reconfiguration. Inadequate and variable signage is part of the problem and a preliminary report on Lab-wide signage improvements was published recently. Implementation of signage and landscape recommendations are anticipated to provide better orientation and way-finding.

About 6600 vehicle trips per day are made to and from Berkeley Lab. Peak vehicle traffic occurs between 4:30 and 5:30 p.m., reaching an average of 642 vehicles per hour in 1991 and an estimated average of 927 vehicles per hour in 1992.

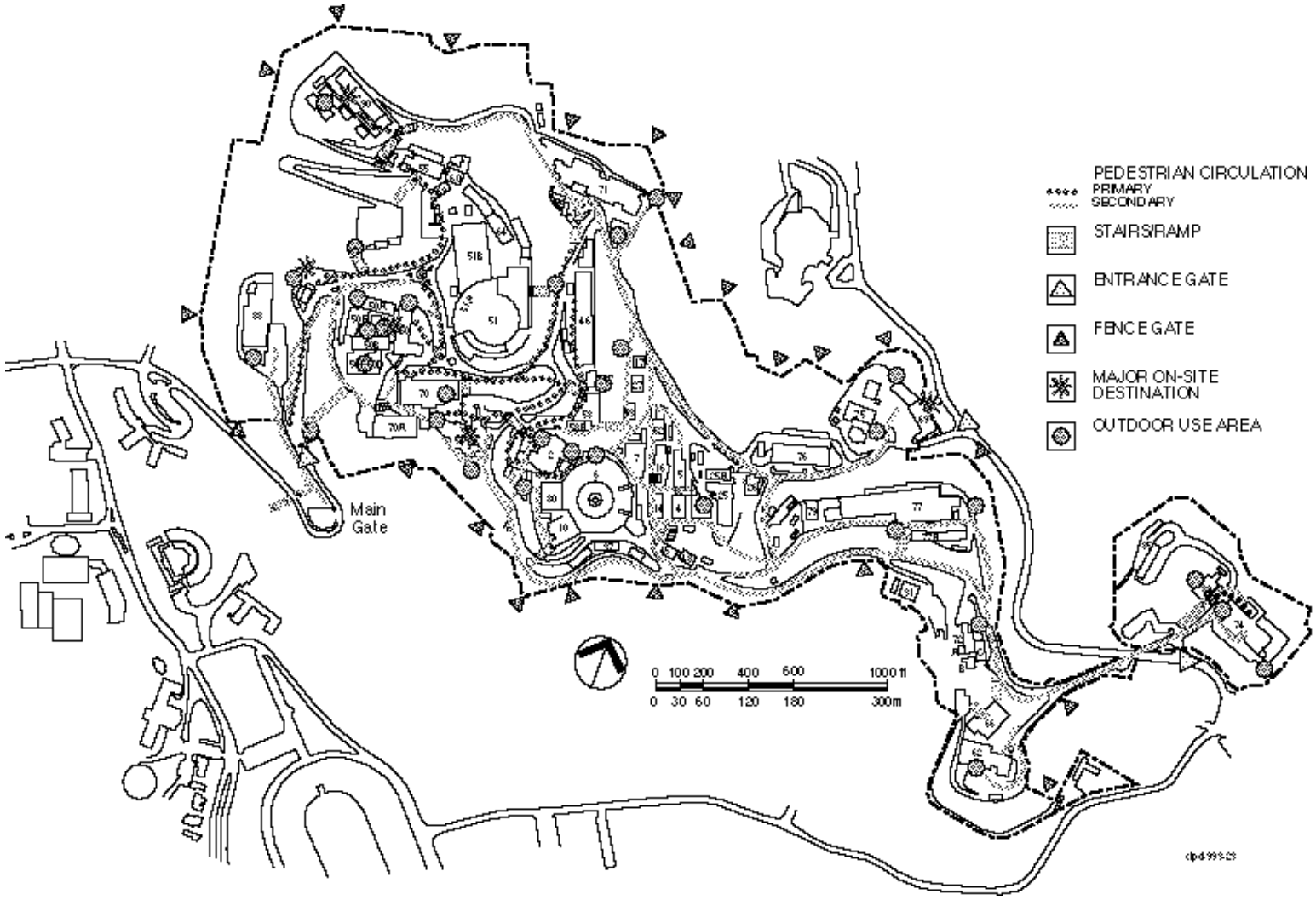


Fig. 2-14. Pedestrian circulation.

1987 traffic studies indicate that 64% of all Berkeley Lab employees drive alone to the site. Seven percent use car pools or van pools; 13% use public transportation; 7% use bicycles; 7% walk, and 2% use two-wheel motor vehicles. Public transit users rely on the Berkeley Lab off-site shuttle bus to reach the Laboratory.

Pedestrian Circulation. Due to the compact site, many buildings are within walking distance of each other, and steep topography has made stairways an important circulation element (Figure 2-14). Major destinations are primarily in the western half of the site. In the central and western portions, footpaths and stair linkages provide good access between facilities. Sidewalks and some footpath/stairway connections are needed through much of the eastern portion of the Laboratory. The site is too steep and hilly for a separate system of bicycle paths, so bicyclists use the roads.

Vehicular Circulation. The Berkeley Lab site is served by an east-west traffic circulation system (Figure 2-15) that conforms to the hilly topography. Vehicles can enter Berkeley Lab through three gates, attended by University Police Services personnel, which are situated to monitor traffic and minimize on-site congestion. Only the Main Gate, also known as Blackberry Gate, near Hearst Avenue is open all the time; Grizzly Gate and Strawberry Gate on the eastern side of the Laboratory are open for various periods according to commute patterns.

The Laboratory's primary vehicle routes are two-way except for three sections where roadside parking reduces traffic lanes, permitting only one-way travel. In addition to necessarily circuitous routes, the one-way portions confuse visitors and new arrivals and cause additional difficulties and expense for construction projects. In several places the antiquated road system requires, for a short distance, two-way circulation along a one lane road. This and other hazardous conditions create traffic choke points in several places. In many areas lack of separation between traffic, service, parking, and pedestrian activities creates unsafe conditions. Proposed and planned roadway projects, as well as a range of smaller, in-house measures such as sidewalk development, have been formulated to address circulation deficiencies.

Service Circulation. The primary delivery route passes through the length of the site (Figure 2-15) along the east-west circulation axis from the Main Gate to the distribution center at Building 69 next to Grizzly Gate. Although service through Grizzly Gate would be more direct and less intrusive to the site, the University limits service and truck traffic on Centennial Drive, the road which serves the eastern gates.

Within the Laboratory, many buildings have multiple service locations because of varied requirements. Central distribution has helped organize and control internal Laboratory servicing activities.

Fig. 2-15. Vehicular circulation.

Transportation by large semi-trailer truck for service or construction is slow because of the site's steep grades and difficult curves. Such movements cause traffic delays, for example, when a heavy truck climbs at three miles per hour up the two-lane main road where passing is not permissible.

Shuttle Bus. Berkeley Lab operates a free shuttle service for Laboratory users, providing both on-site and off-site routes (Figure 2-16). The system facilitates circulation and access, minimizes the use of personal vehicles, and supports use of mass transit. The bus service reduces on-site traffic yet allows access to every building on the site within a reasonable amount of time. The off-site shuttle serves downtown Berkeley, connecting with BART and AC Transit stops.

The shuttles make 98 on-site trips and 70 off-site trips per day. In 1993, shuttle service expanded to provide an additional seven commute hour trips to the BART line at Rockridge and three late evening runs through the site and to downtown Berkeley. Plans call for increasing service commensurate with population increases (Table 2-10).

Parking

Major Laboratory destinations are located in the western portion of the site, which also has the highest populations and greatest parking need. Parking at Berkeley Lab is located in small surface lots (some with a stacked configuration), along roads, and in every feasible nook and space (Figure 2-17). Trailers serving as temporary office and storage space have been placed in parking lots, reducing available parking space. Because steep topography limits significant expansion of surface parking, parking demand continually exceeds availability.

Berkeley Lab provides parking space for 1,800 vehicles and 280 government-owned vehicles which are stored on-site for day use. Limited additional space is reserved for time-limit, emergency, disabled, and visitor parking. Considering only the on-site population of 3,500 people (1994), Berkeley Lab meets the recommended ratio of 1.7 persons per parking space. Since many of the Laboratory's 500 UC campus-based employees also park on the Berkeley Lab site, the parking ratio rises to approximately 1.8. Future Laboratory population growth will exacerbate current parking difficulties.

Berkeley Lab has a three-level parking permit system which provides nearby parking for upper management, reserved spaces for senior scientific and management staff or employees with medical permits, and general parking for all others. New graduate students are allowed to park on-site only during off-hours. Visitors and consultants are provided a permit or reserved space as needed.

Berkeley Lab has implemented a comprehensive trip management program to encourage the use of bicycles, public transportation, free shuttle buses, carpools, and other measures designed to reduce employee-related vehicle trips. Van pooling and car pooling are encouraged by providing reserved parking for 'pool' vehicles.

BUILDINGS AND OTHER STRUCTURES

The Berkeley Lab building and space inventory includes many types of facilities, including on-site permanent buildings, on-site trailers and miscellaneous structures, off-site leased building space, and the UCB Campus space assigned to Berkeley Lab.

The Laboratory's on-site space (about 78% of the gross) consists of approximately 150,600 gsm (1,621,100 gsf) with an approximate 70% efficiency, so that net usable on-site space is approximately 105,400 m^2 (1,134,800 sq ft). With a typical daily on-site population of 3,500 employees and participating guests, the average net occupied office space is about 10 m^2 (110 sq ft) per person. About 4% of the on-site space consists of trailers or other temporary structures.

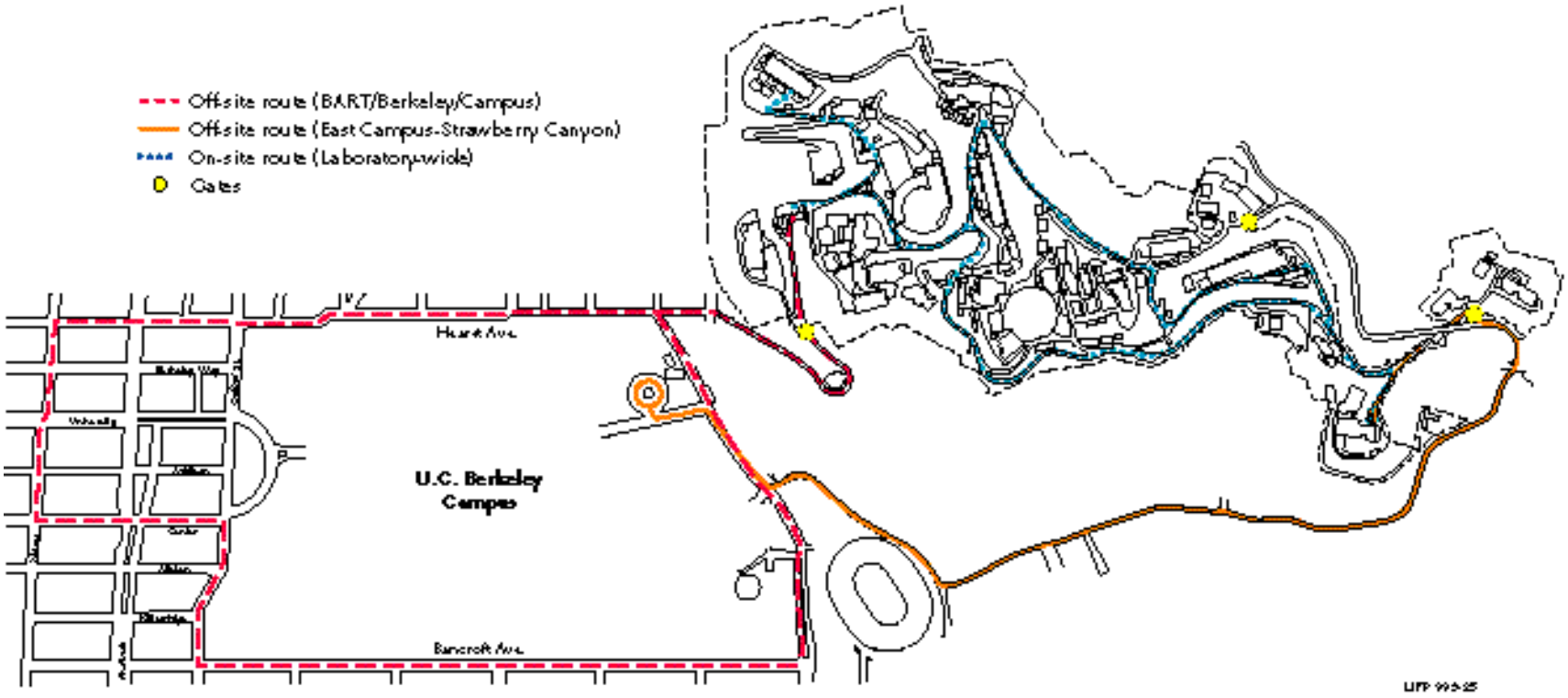


Fig. 2-16. On- and off-site bus service.

Table 2-10. Transportation and Parking Characteristics.

Characteristic	1992	Future
Parking*		
Total spaces	1,764	2,410
Population/space ratio	1.8	1.70
Peak Vehicle Trips (per hour)	642	950
Off-site Shuttle Service		
Trips/day	77	82
Passenger capacity/day	2,900	3,300
Passengers carried/day	1,400	1,950
Use (%)	48	59
On-site Shuttle Service		
Trips/day	102	110
Passenger capacity/day	1,900	1,090
Passengers carried/day	900	1,330
Use (%)	47	64

*1991 data.

One of the Laboratory's divisions, Life Sciences, is partly housed on the UCB campus; a second, Structural Biology, is housed totally on campus, except for the National Tritium Labeling Facility in the Shops and Support Facilities Area. Together, these two divisions occupy about 3,800 net m^2 (41,000 net sq ft). Berkeley Lab personnel also occupy other space on the UC campus, at the UC Richmond Field Station, leased space in the City of Berkeley, and at the Stanford Linear Accelerator Center (SLAC). Overall, about 18% of Berkeley Lab personnel occupy off-site space.

On the main site, of the 150,000 gsm (1.6 million gsf) in buildings, 33% are adequate buildings, 54% are substandard but can be made adequate, and 13% are substandard and should be demolished or removed (Table 3-5 and Appendix C).

ENVIRONMENT, **S**AFETY AND **H**EALTH **P**OLICIES

Berkeley Lab is committed to environmental, health and safety protection for all employees, visiting scientists, customers, neighbors, and others who may be affected by Berkeley Lab research and related activities.

Berkeley Lab policies are founded on sound management principles that ensure full compliance with all applicable laws and regulations. The Environment, Health and Safety (EH&S) Division is committed to working with line management to meet five basic environment, health and safety principles:

- To provide Berkeley Lab employees with a safe workplace
- To provide technical support in the design and operation of Berkeley Lab facilities and research activities to minimize adverse impact on public health and the environment
- To oversee production and use of materials to ensure safe disposal and minimal impact on the environment and minimize waste
- To promptly communicate to affected persons the known hazards of Berkeley Lab activities and the related methods necessary for safety and health protection
- To provide guidance on the use of available technology, engineered safeguards and responsible science to mitigate significant risks arising from Berkeley Lab research and related activities

Health and Safety Programs

All Berkeley Lab facilities establish and maintain industrial hygiene, safety, fire protection, and medical programs that meet or exceed standards of good professional practice.

The Berkeley Lab Industrial Hygiene Program provides for the recognition, evaluation and control of occupational health hazards. The program includes reliable measurement and documentation of potentially hazardous workplace exposures, and disclosure to affected employees of all potential hazards. Programs provide for the use of appropriate engineering controls, protective practices, and personal protective equipment.

The Berkeley Lab safety program provides for employee personal safety, facility security, fire protection and process safety. Berkeley Lab establishes local exposure limits or complies with established regulatory standards to protect the health and safety of its employees and visitors, and of local communities and other groups affected by Berkeley Lab activity.

Fig. 2-17. Parking.

The Berkeley Lab Fire Protection Program maintains a fire protection staff adequate to identify, evaluate, and control potential fire and life safety hazards. The program ensures that fire will not cause an unacceptable onsite or offsite release of hazardous materials that would threaten the public health and safety or the environment. In addition, the program is aimed at minimizing the potential for fire or related perils that might impact the Laboratory or DOE missions.

Berkeley Lab provides employees with a mandatory pre-employment physical examination and with voluntary periodic physical examinations thereafter. Examinations may be required for employees potentially exposed to specific hazards. Employees with occupational injuries or illnesses are evaluated and treated promptly, with emphasis on rehabilitation and return to work at the earliest time compatible with job safety and the employee's health. The Medical Clinic staff and Employee Assistance Program staff provide counseling and education to employees on health matters.

All Berkeley Lab employees with potentially hazardous occupational exposures are offered a health monitoring program.

Berkeley Lab maintains records of all workplace accidents, illnesses and injuries for the purpose of measuring Lab-wide and systemwide safety performance. All significant accidents are reported and investigated promptly by the appropriate line management unit.

Each quarter, Berkeley Lab presents environment, health and safety awards to foster awareness in these areas. The individuals recognized have demonstrated outstanding achievements in environment, health, safety or loss prevention.

Protecting the Environment and Public

Berkeley Lab conducts process safety analysis on all potentially hazardous facilities and operations and evaluates potential releases to determine their possible effect on the environment and local community. Where significant hazards are identified, appropriate control strategies are implemented to ensure protection of the public.

Each Berkeley Lab division establishes safety procedures to provide for environment, health, and safety assurance of existing processes and activities, significant new uses of materials, or process changes.

Berkeley Lab keeps its spill plans and emergency response plans current. Berkeley Lab also keeps the local community informed of potential hazards associated with its operations, and conducts joint emergency response planning and exercises with the community through the Community Awareness and Emergency Response (CAER) Program.

Air emissions, waste water discharges, and solid wastes are evaluated to identify any potential effect on public health or the environment. Berkeley Lab complies with the requirements of the Clean Air Act, Clean Water Act, RCRA, TSCA and other applicable environmental laws, as well as with DOE Orders in reference to these laws. Exposure limits are established and appropriate waste management strategies are implemented to prevent any significant adverse impact.

Berkeley Lab complies with all environment, safety and health requirements of Department of Energy Orders as specified in Contract 98 between the Department of Energy and The Regents of the University of California concerning Berkeley Lab. Where past activities have resulted in risks to the public or the environment, Berkeley Lab acts to minimize or remove those risks and cooperates fully with regulatory agencies and other interested groups.

Waste Disposal and Minimization

All waste disposal meets the highest current standards for safety, health and minimal environmental impact. Berkeley Lab minimizes the production of hazardous, mixed and radioactive wastes in all forms, including air emissions, waste water releases, and solid wastes. Each Berkeley Lab division provides for setting exposure limits for raw materials, intermediates, wastes, or other environmental releases.

For each of its materials, each division prepares or obtains a material safety data sheet (MSDS) that effectively communicates accurate environment, health and safety information. MSDSs are provided or made available

to all affected employees, customers, carriers, local communities, and emergency response personnel. Reagents, products and other materials are packaged and transported safely.

Hazard Communication

Berkeley Lab communicates to employees industrial hygiene monitoring data, the results of health studies, significant new toxicity data, safe handling techniques, workplace and environmental hazards, and results of employees' own personal medical tests.

Appropriate environmental, health and safety information is communicated to visiting scientists, students, contractors, carriers, members of the public, regulatory authorities, and emergency response authorities.

Berkeley Lab divisions or facilities promptly notify the EH&S Division when they are involved in a reportable occurrence, as defined by DOE Order 5000.3B.

Risk Management

Each Division uses EH&S guidance to perform documented risk assessments to identify, characterize, and mitigate potential hazards arising from their activities.

To the extent possible, risk assessment and risk management are performed as separate functions. Risk management includes selection and implementation of the appropriate risk reduction methods, including training, formal procedures, environmental monitoring techniques and frequency, and design and application of engineered safeguards.

From time to time, Berkeley Lab conducts, sponsors or participates in appropriate studies to develop new data as needed for risk assessment and reduction, such as an interactive MSDS and chemical inventory, labels, and other environment, health and safety needs.

Human and Animal Health Effect Research

Berkeley Lab follows established Department of Energy (DOE) and Department of Health and Human Services (DHHS) principles and regulations to safeguard the welfare, privacy, and rights of human research subjects and ensure the humane treatment and proper care of animals used in research. All research involving human subjects and animal subjects is reviewed and approved by the appropriate Berkeley Lab committees and, for protocols using human subjects, by the U.C. Berkeley Committee for Protection of Human Subjects.

Implementation of Policies

Each Division Director ensures that the environment, health and safety policies are implemented, as established by EH&S and set forth in the *Ernest Orlando Lawrence Berkeley National Laboratory Health and Safety Manual*, PUB-3000.

Berkeley Lab implements an assessment function through the Office of Assessment and Assurance (OAA). Assessment is conducted periodically to assure compliance with applicable laws and regulations and with Berkeley Lab policy. Significant findings are reported promptly to senior management.

Each Berkeley Lab Division performs a self assessment that documents achievement of EH&S policies and goals as required by the *Ernest Orlando Lawrence Berkeley National Laboratory Self-Assessment Manual*, PUB-3133.

Berkeley Lab is committed to active participation in the regulatory process. Together with other national labs, trade associations and other groups, Berkeley Lab maintains a continuing dialogue with interested parties and seeks reasonable solutions for society's environment, health and safety concerns.

In compliance with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA), Berkeley Lab ensures that governmental decision makers and the public are informed about the potential significant environmental effects of Berkeley Lab's proposed activities—before actions are taken—and identifies ways that environmental damage can be avoided or significantly reduced.

Environmental Evaluation and Status

Environmental monitoring (air, water, and land) is conducted by Berkeley Lab's EH&S Division personnel. Monitoring stations for each component are represented in Figure 2-18. Off-site sampling is conducted to provide

information regarding public safety. For a listing of regulatory agencies that govern environmental compliance see Chapter 1, Regulations and Planning Requirements.

Air

Potential air pollution consists of chemicals and radionuclides released from stacks at laboratories. Each building is actively monitored for compliance with applicable air-quality standards, and present release levels meet these safety standards. Experiments that could generate noxious fumes or vapors are confined to fume hoods. Airborne wastes are minimal due to the small amounts of chemicals involved in the research.

Processes with a potential for pollution are reviewed during conceptual stages to identify those that require "Permits to Construct" from the Bay Area Air Quality Management District.

Water

In chemical laboratories, small amounts of water-soluble chemical wastes are allowed to be discharged to sanitary sewer drains, following guidelines published in the *Ernest Orlando Lawrence Berkeley National Laboratory Health and Safety Manual*, PUB-3000. Wastes from plating or metal cleaning shops and laboratory acid wastes are collected and pretreated before discharge to sanitary drains. In accordance with Berkeley Lab policy, non-water-soluble chemical wastes are collected at their points of generation, segregated into compatible groups, placed in approved shipping containers, and transported to a DOE site for burial or recycling.

Chemical wastes are not discharged to storm drains or streams. Other potential water pollution sources are from contaminated soils, which are discussed in the following section. As noted below, Berkeley Lab is conducting a labwide characterization study of water and soil contamination.

Land

Sources of potential soil pollution are accidental spills from routine operations, transportation of materials, or leaking underground tanks. Solvents, fuels, and other hazardous liquids are controlled through EH&S Division procedures and training. Improvements include construction of new storage containers, the installation of overflow/leak containment, and the use of impervious materials.

Collection and processing of hazardous wastes are performed in a specially designed Hazardous Waste Handling Facility that includes the proper equipment and configuration as defined by regulating authorities. Hazardous waste is consolidated and packaged to meet U.S. Department of Transportation regulations and then trucked to approved DOE disposal sites. Nonhazardous wastes are regularly collected at Berkeley Lab by the University and transported to a recycling company, where 90% of the volume is recycled.

Environmental Restoration and Waste Management

Berkeley Lab environmental management site projects are supported through the DOE Office of Environmental Restoration and Waste Management (ERWM). They are directed toward restoring environmental conditions at the Laboratory and to improving the management of waste handling operations in support of DOE's national environmental objectives. The corrective actions achieve and maintain required low exposure and risk levels. The environmental restoration program includes the assessment and characterization of contamination, and closure of the existing Hazardous Waste Handling Facility. Continued support for the waste management program and for construction, currently in progress, of the new Hazardous Waste Handling Facility is necessary for the proper management of radioactive and hazardous waste.

These programs provide for compliance with DOE and other Federal regulations and for meeting requirements established by state and local agencies. The Environmental Management (EM) 5-year plan is focused on three Environmental EM programs for restoration and management activities:

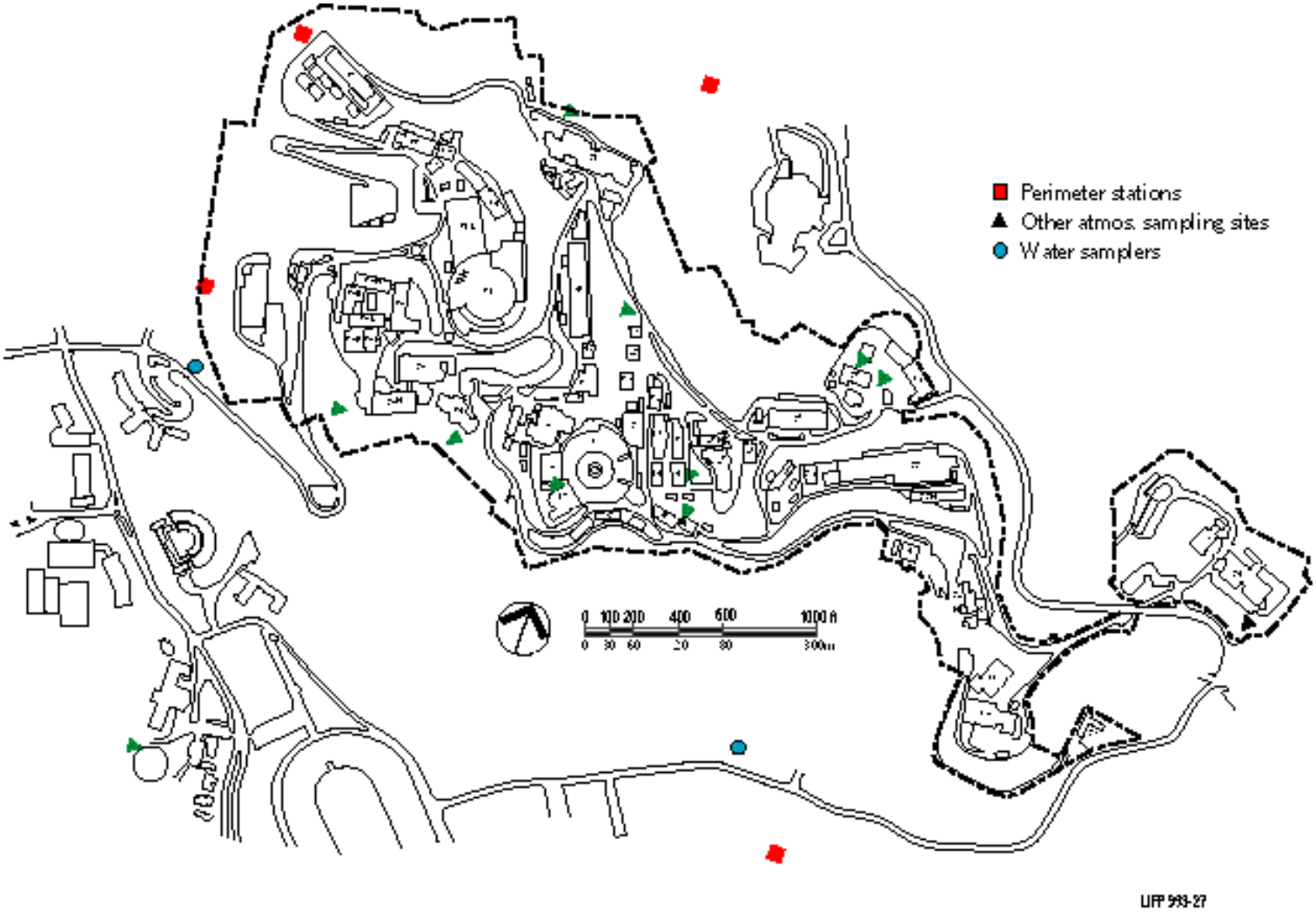


Fig. 2-18. Environmental monitoring locations.

- ***Environmental Restoration***. Assessment, characterization, and remediation of chemical contamination of soils and groundwater and closure of the existing Berkeley Lab Hazardous Waste Handling Facility and decontamination and decommissioning of the Bevalac
- ***Corrective Activities.*** Corrective actions to achieve compliance with environmental regulations that protect soils, groundwater, and air and also prevent chemical discharges to sewers. Essential corrections are to laboratory ventilation systems, deionization systems, sanitary sewer systems, chemical storage tanks, and wastewater treatment units
- ***Waste Management***. Waste management program for continuity of hazardous and radioactive waste handling operations, disposal, waste minimization, planning, and management of the construction of the new Hazardous Waste Handling Facility. Additional funding of waste management operations will be necessary to meet mandatory program requirements.

The Laboratory's systematic and prioritized input to the EM Five-Year Plan supports DOE's national environmental restoration and waste management goals. The plan responds to specific environmental conditions at the Laboratory and includes facilities and operating programs for managing those conditions to maintain air quality, surface water quality, and groundwater quality.

Operational Safety

No significant radiation levels are expected in accelerator experimental areas. Accidental exposure of personnel is limited primarily by passive systems (shielding) and by active engineering and administrative controls, such as electrical interlock systems to prevent access to radiation areas, audible and visible warnings, and surveillance of experimental operations. Radiation levels at the fence line are not expected to increase as a result of Berkeley Lab operations.

Continuing reviews during the conceptual and design stages and preparation of an Activity Hazard Document (AHD) are mandatory for all potentially hazardous experiments. The AHDs are reviewed by the Berkeley Lab EH&S Division's technical staff of professionals. As a standard procedure of the Berkeley Lab safety program, all areas are regularly inspected for compliance with Federal Occupational Safety and Health Administration (OSHA), DOE, and Berkeley Lab standards. Routine design review of equipment and laboratory facilities and review of experimental procedures are expected to reduce all hazards to a "low-hazard" classification.

Corrective Action Plan

Berkeley Lab's Tiger Team Assessment Corrective Action Plan, completed in September 1991, addresses the findings and concerns of the Tiger Team as well as the 1989 Technical Safety Appraisal. The Laboratory and DOE/SF developed 409 tasks with subsidiary milestones to correct the findings and concerns and eliminate the underlying root causes. These root causes addressed the need for:

- Greater formality of operations and effective verification of the accomplishment of environment, safety, and health requirements
- More effectively addressing the challenge of environmental, safety, and health demands and the urgency of incorporating these demands into Berkeley Lab operation
- Providing DOE program direction and oversight that places adequate emphasis on environmental, safety, and health requirements

Berkeley Lab has closed out 82% of the OSHA findings and has fully corrected the Category II concerns or reduced them to lower levels. However, addressing all the root causes, concerns, and findings will be accomplished through the Berkeley Lab Corrective Action Plan, which will require additional resources from the Office of Energy Research

and the Office of Environmental Restoration and Waste Management. Berkeley Lab is allocating significant new resources to the Corrective Action Plan, including additional office and support facilities described in subsequent chapters of this CFP.

Safety and Health Five-Year Plan

The Laboratory has developed a prioritized five-year plan for Safety and Health Activities that includes the existing core program of safety and health services and activities, additional core support, and specific projects needed to fully meet all Berkeley Lab and DOE safety and health goals. Berkeley Lab planning has contributed to the development of the ER prioritization system to allocate and rank necessary activities based on quantitative risk reduction criteria. GPP and MEL-FS projects included in this CFP address the ES&H five-year plan needs.

Waste Minimization Plan

Berkeley Lab's waste minimization program is an organized, comprehensive, and continual effort to systematically reduce hazardous, radioactive, and mixed waste generation. The Waste Minimization and Pollution Prevention Awareness Program are designed to eliminate or minimize pollutant releases to all environmental media from all aspects of the site's operations. These efforts offer increased protection of public health and the environment. They will yield the following additional benefits: reduce waste management and compliance costs; reduce resource usage; reduce or eliminate inventories and releases of hazardous chemicals; and reduce or eliminate civil and criminal liabilities under environmental laws.

OTHER **I**MPROVEMENT **P**ROGRAMS AND **A**SSESSMENTS

The Laboratory has implemented a long-range plan to improve the condition of the physical plant and operations with respect to maintenance, repair, safety, and the environment. Highlights of these improvements are described below. The 20-Year Plan goals for the Laboratory are presented in Chapter 4; specific implementation over the ten-year planning period is described in Chapter 5.

Seismic Safety

All physical plant facilities have been reviewed for seismic safety (Appendix A). Since 1971 over 34 buildings with significant seismic deficiencies have been strengthened to meet the new standards. Other improvements in earthquake-resistant facilities and emergency preparedness include the following:

- Two on-site water storage and emergency pumping stations have been constructed to provide water for fire protection if public supplies are lost.
- An emergency command center has been established and hardened for earthquake safety.
- Emergency generators, communication systems, medical facilities, the firehouse, and other life-line systems have been obtained, or strengthened, for use following an earthquake.
- Earthquake shutoff valves have been installed on all natural gas mains.
- An emergency telephone system has been installed.

Slope Stability

Fifteen areas of instability have been stabilized on a priority basis. A sophisticated groundwater monitoring and soil drainage system was installed, including many vertical wells and horizontal hydraugers that have been effective during extremely wet winters. In response to a 1974 analysis of potential slope instability during a major earthquake, critical underground water, natural gas, and electrical lines have been relocated. Slope stability has been improved along the realigned portion of the Upper Hill Road as a result of the Roadway Safety Improvements

Project (see below). An additional slope and seismic stability project was recently completed to correct problems in the Building 51/71 area.

Underground Utilities Improvements

Nearly half of all sewer systems have been videotaped and inspected to determine preventive maintenance and replacement tasks for short- and long-term funding. Recently completed construction projects replaced a portion of the underground utilities (potable water, low-conductivity water, compressed air, natural gas, storm drainage, treated water and sanitary sewer systems) as well as above-ground cooling towers in the Light Source Research and Engineering Area. Rehabilitation of all older 12-kV cables is planned as MEL-FS funds become available.

Roadway Safety Improvements

The Laboratory's road system was established when design and safety standards were less stringent and there were few pedestrians. Current conditions require improvements such as vertical and horizontal realignment of roads, widening of traffic lanes, replacement of base and paving materials, and separation of vehicle and pedestrian traffic. A roadway-safety improvement project was completed in 1986 in the Light Source Research and Engineering Area that provided a safer passageway for both vehicles and pedestrians. Three phases of Road Rehabilitation Projects are proposed to improve or replace the remaining Laboratory roadways systematically.

Energy Management Improvements

Berkeley Lab energy use has been reduced over the last several years by improvements both in operations and in building design. Energy metering throughout the site includes 100 electric meters and 50 gas meters. Meters are read regularly, and a database has been established. This database is used in the In-House Energy Management (IHEM) Program to recharge users for consumption, identify efficiency opportunities, and monitor performance.

Currently, the IHEM Program is conducting 20 separate studies totaling $771,000. These studies are focused on improving the energy efficiency of Berkeley Lab HVAC, elevators, vehicle fuel, personal computers, and process loads.

The IHEM Program is also managing the design, construction, and operation of 26 separate retrofit projects totaling $13,950,000. The retrofit projects include a site-wide Energy Management and Control System (EMCS), site-wide lighting improvements, site-wide motor replacements, HVAC equipment replacement, electrical and compressed air meters, and a shared energy savings contract.

Utility service management continues to be an important aspect of the Berkeley Lab energy management program. Berkeley Lab now purchases most of its electrical power from the Western Area Power Administration (WAPA), thereby saving approximately $1 million annually. Berkeley Lab purchases natural gas from the Defense Fuel Supply Center (DFSC), saving approximately $100,000 annually.

Berkeley Lab works in conjunction with the DOE/OAK Office to negotiate utility contracts. Goals for utility acquisition are shown below.

- Monitor continuously evolving utility rate structures to seek the best power mix for Berkeley Lab programs.
- Monitor the posture of WAPA for the post-1994 marketing plan and work in concert with DOE/OAK and special consultants for increased allocation from the new marketing plan.
- Seek other unused or set-aside portions of WAPA power, as Berkeley Lab has successfully done in the past.
- Monitor natural gas purchasing options to ensure lowest rates.

Fire Protection Improvements

Major buildings are being upgraded to meet the latest fire protection and life safety standards, since uses of many buildings have changed over the years. Sprinkler systems have been installed in all buildings. Specialized equipment, such as computers, fume

hoods, and experimental apparatus, is provided with appropriate fire-suppression systems. Use of halon fire extinguishing agent, which contains ozone-depleting CFC, is being phased out in compliance with the Montreal Protocol on Substances of 1989, and with DOE policy.

Barrier Reduction for Handicapped Persons

Improved access for physically disabled persons has been provided to the Berkeley Lab auditorium, medical clinic, cafeteria, central research laboratories, Director's Offices, and main administrative offices. Suitable toilet facilities have also been provided for handicapped persons.

Environmental Design Improvements

Landscaping. Improvements in esthetics and access have been made to the main entrance road and adjacent parking areas, the shuttle-bus terminal, and all the main intersections along Cyclotron Road and the Upper Hill Road. Bus shelters have been installed, and landscaped walkways, including improved lighting, have been provided from the main parking areas to main buildings. The site perimeter fence along Cyclotron Road has been moved to a less-obtrusive location below the road. Landscape plans are required for all new construction, and guidelines require low-maintenance, fire-resistant vegetation. A landscape architect firm is developing a comprehensive landscape plan for use in future development and redevelopment of the site.

Signs. Some standardized signs that are compatible with the natural setting and are easy to modify and maintain have been installed. However, many nonstandard and sometimes confusing signs need to be replaced. A continuing signage study includes review of existing signs, a recommendations for future standards, and a schedule for implementation. Road signage is considered a critical need.

Painting and Roofing. A coordinated color scheme is being developed for the Laboratory's buildings, including roofing materials and landscaping, that complement the natural tones of the hillside. All Berkeley Lab buildings have been or will be repainted to conform to this scheme.

Maintenance

The goal of Berkeley Lab's maintenance program is to provide a safe and reliable physical plant forBerkeley Lab's research programs. Past budget constraints have resulted in curtailed maintenance, repairs, and replacements. Some progress in reducing backlogs has been achieved through MEL-FS funding, but increases in GPP and GPE funding are needed to ensure a reliable infrastructure.

Berkeley Lab carries out a formalized maintenance-management program, and it has included a computerized scheduled-maintenance system. Budget requests are based upon inspections by Berkeley Lab's Facilities Department and consulting firms in specialized areas, such as cranes, elevators, boilers and pressure vessels, fire protection, slope stability, storm drainage, seismic safety, underground utilities photography, and energy use, with review by the Facilities Department. An upgrade of the Plant Inspection and Maintenance System was begun in 1988 to improve facilities evaluations and to develop a plan for short- and long-range corrective actions.

The formulation of the maintenance budget is an iterative process that takes into account plans for noncapital alterations, general plant projects, multiprogram general-purpose line items, and regular line-item construction. This process includes consideration of other operating-budget priorities, and culminates in a formal work plan for the fiscal year approved by the Associate Laboratory Director for Operations. Since maintenance and repair requirements also occur continuously throughout the fiscal year, allowances are made for meeting these requirements expeditiously.

Longer-range plans at Berkeley Lab are developed for items of major maintenance, such as reroofing, paving, slope stabilization,

major equipment overhaul, building rehabilitation, building exterior painting, and utilities replacements. A five-year projection is made with specific projects itemized over the first three years and lumped for the last two (see Chapter 5).

Plant operations and surveillance are carried out by the Maintenance Shops 24 hours a day, 7 days a week, under an area maintenance concept. Some maintenance projects, such as paving, reroofing, chiller overhauls, and exterior painting and certain specialized services, such as pest control, window washing, and refuse disposal, are subcontracted when cost savings and/or improved efficiencies result. Responsibility for engineering design of maintenance projects lies with the appropriate Facilities Section Leader.

Site Deficiencies Summary

The older original area of the Berkeley Lab site was developed in the 1940s, making it one of the oldest laboratory complexes in the DOE system. With few exceptions, most of these older facilities are substandard or obsolete. Vehicle and pedestrian circulation routes are generally narrow, indirect, and substandard. Electrical and mechanical utility systems and load centers in the area have ample capacity but are aged, inflexible, and unreliable. Portions of these systems—water, electrical, gas, sewers, and compressed air—have already exceeded their useful lives. Rehabilitation, modernization, or replacement is now necessary. Communication systems have been upgraded by the ICS Project and will only require extension to new facilities.

Present standards, in terms of energy conservation (reducing costs) and flexibility and reliability (responding to disruptions), greatly exceed the original design capabilities of the Berkeley Lab utility distribution system, and timely rehabilitation and modernization are imperative to serve current and projected research programs safely and efficiently. Shortages of both laboratory and office space at Berkeley Lab have remained acute over the last 10 years, impeding the effective and efficient conduct of scientific research and adding significant operational costs. A continuing program of EH&S improvements is needed for full compliance and environmental restoration.

FACILITIES **D**ECOMMISSIONING **P**LAN

The development of new program directions for nuclear physics has resulted in the shutdown of Berkeley Lab's Bevalac nuclear physics program. The Bevalac decommissioning plans are being developed between Berkeley Lab, OER, EM-60 and EM-40. Operations were curtailed in mid-FY 1993. A "stand-down and secure" phase was conducted by Berkeley Lab in FY 1993 and continues in FY 1994. Subsequent planning, activities and funding are being identified by the responsible DOE office and Berkeley Lab.

The Laboratory conducts periodic reviews of facilities that may become inactive. Other facilities to be decommissioned include gamma irradiators. See Table 2-11.

Table 2-11. Facilities Decommissioning Plan ($M)

Project	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999
Bevalac:						
Stand-down & secure (OER)	4.0	2.0	—	—	—	—
Transition (EM-40)	1.15	3.0[a]	3.0	3.0	—	—
D&D (EM-40)	—	—	—	—	15.0	21.0
Gamma Irradiators	0.3	—	—	—	—	—
Decommissioning Base Program	0.4	0.6	0.6	—	—	—
Total	5.85	5.6	3.6	3.0	15.0	21.0

[a]FTPA for $3M in FY 1995 submitted to OER pending committment of EM-60 funding.

3. PLANNING ANALYSIS

FACILITIES AND **A**SSET **P**LANNING **P**ROCESS

Berkeley Lab Planning Process and Organization

At Berkeley Lab, planning is an integral element of a Comprehensive Planning Calendar. An annual planning cycle defines and updates both Strategic/Institutional and Capital Planning/Infrastructure needs in a coordinated manner.

The Laboratory maintains both Strategic/Institutional and Capital Planning/Infrastructure planning initiatives regarding its facilities. Strategic/Institutional planning initiatives are lead by the Office for Planning and Development while the Capital Planning/Infrastructure planning initiatives are lead by the Facilities Department. These inter-related planning processes are documented in four primary documents; the Institutional Plan, the SDP, the CFP, and the Maintenance Plan.

The Associate Laboratory Director for Planning and Development (see Figure 3-1) is responsible for the preparation of the Laboratory's Institutional Plan. It is through the Institutional Plan that the Laboratory's strategic goals and objectives are refined and communicated to the broader laboratory community.

The Associate Laboratory Director for Operations is responsible for preparing the SDP and CFP, which includes the Laboratory's capital asset/infrastructure planning. The Associate Laboratory Director for Operations has designated the Facilities Department

Fig. 3-1. Organization chart.

as the lead organization for the capital asset/infrastructure planning efforts. To ensure that the Laboratory's capital asset/infrastructure planning is both inclusive and accurate, the Facilities Department coordinates with both Scientific and Resource Divisions (Resource Divisions include Environment, Health & Safety; Engineering; and Information & Computing Sciences as well as the Facilities Department). This planning process is documented in three reports, the SDP, CFP, and the Maintenance Plan.

The Office for Planning and Development and the Facilities Department Planning Unit meet regularly to discuss topics of mutual interest and concern.

Capital Asset/Infrastructure Plan

Capital asset/infrastructure needs are identified through an annual "Unified Call" for construction projects. The "Unified Call" is the primary method of project identification at the Laboratory. The "Unified Call" for construction projects (Non-Capital Alteration through Line Item Project) is issued annually to all Scientific and Resource Divisions. It is through the "Call" that the Facilities Department enters current Condition Assessment Survey (CAS) findings into the project planning process (see Figure 3-2). (To ensure an open and inclusive planning process the Facilities Department also accepts new construction project ideas through the Work Request Center. Any member of the Laboratory community can initiate a project request through the Work Request Center. When a proposed project could affect the relative ranking of any project on a Scientific or Resource Divisions "Call Response List" this project proposal is reviewed with the Division involved.)

The Facilities Department evaluates and prioritizes each of the project requests identified through the "Call," rating each using both the Capital Asset Management Process (CAMP) and Risk-Based Priority Matrix (RPM) rating systems. Project proposals are also reviewed for consistency with the Institutional Plan, the SDP, the CFP and the Site-wide Environmental Impact Report (SEIR). Project proposals are ranked by CAMP and RPM rating.Items which are not consistent with existing plans are noted (these notes are considered both during the project prioritization process and during the next revision process for the respective plan). The Facilities Department then breaks the list into sub-lists allocating projects into their appropriate funding category (e.g. Non-Capital Alteration, General Plant Project, Line Item Project). These sub-lists are the "Planning Lists" noted on Figure 3-2. Each of these funding category sub-lists are then reviewed by the Project Coordination Committee.

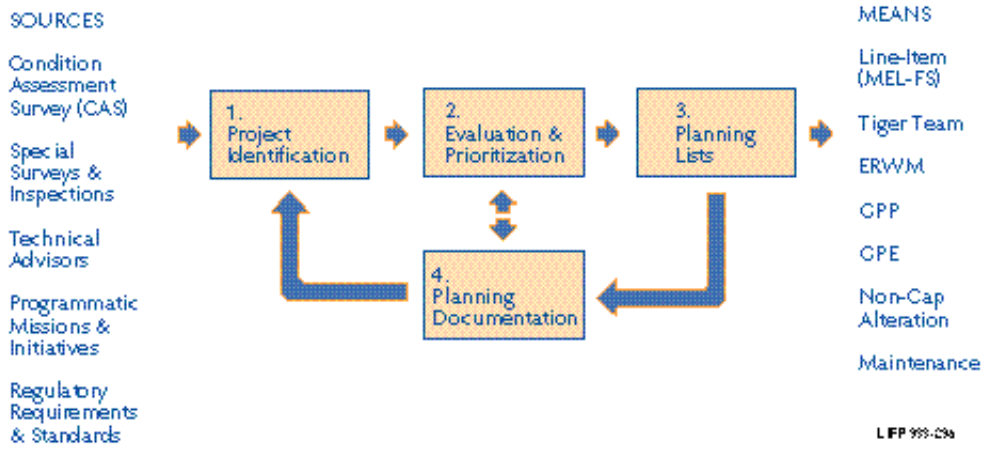


Fig. 3-2. Project planning process.

The Project Coordination Committee is chaired by the Facilities Department and consists of representatives of each of the Laboratory's Resource divisions and the Office for Planning and Development. The Committee performs two functions: 1) it informs all Resource Divisions of upcoming projects and allows for advance coordination when this is required, and 2) it provides a broad-based review of the CAMP and RPM ratings.

The Project Coordination Committee may bring forward new information regarding any project and request further examination of that project to ensure it is appropriately rated. When the final lists of ranked projects are compiled the top-rated projects are submitted for funding, to the extent that funds are available. This list of proposed projects is then submitted to a review committee, consisting of the Facilities Manager and the Director of the Environment, Health and Safety Division, which reviews the lists and advises the Associate Laboratory Director for Operations regarding the preparation of a final list. The final list is submitted to the Directors Action Committee for review and approval. All lists include a "below-the-line" listing of those high-priority items for which funds are not available. If additional funds become available (e.g. projects may be completed at a cost below budget) then the highest ranked project(s) on the "below the line" list is moved up and funded. Projects which are not funded are reviewed with the proposing Division periodically during the year and may be resubmitted for funding during the next "Unified Call" process.

The "Call" also provides the Laboratory with insight regarding future space and building requirements. All proposed projects are reviewed for any space needs or building requirements. Specific space needs are also recorded (e.g., a need for highbay or cleanroom space). This information is reviewed when the Laboratory's planning documents (i.e., the Institutional Plan, the SDP, and the CFP) are updated.

STRATEGIC/**I**NSTITUTIONAL **P**LAN

Strategic Planning

During FY 1992 Berkeley Lab initiated a strategic planning process to assess the Laboratory's programmatic and operating context, refine its mission and vision, and address specific issues and program objectives. The Laboratory has undertaken these activities while also working with other national laboratories to enhance a mutual R&D role in support of the nation's R&D and technological infrastructure. The outcome of these planning activities is being incorporated in the Institutional Plan, SDP and CFP documents.

Berkeley Lab has developed a vision statement as the first step of a strategic planning process to maintain the Laboratory as one of the nation's premier scientific institutions. Drafted by senior management, Berkeley Lab Vision 2000 calls for building upon Berkeley Lab's strong scientific, technical, and educational resources to gain a competitive advantage that will carry the Laboratory forward well into the next century. Elements of the Berkeley Lab Vision 2000 are to:

- *Distinguish ourselves as a premier DOE multiprogram national laboratory by performing research of the highest scientific quality*. We will build on our educational and technical resources to gain a competitive advantage in addressing problems of national significance and advancing the mission of the DOE.
- *Create value for the economy, enhance education, and contribute to the community* through partnerships with industry, universities, and other laboratories.

- *Make Berkeley Lab the location of choice for facilities and programs*. Our operational, administrative, and technical resources will integrate seamlessly with the research and engineering programs. All of our activities will be conducted with full regard for the environment, health, and safety.
- *Commit to developing our people to their fullest potential.* We value and seek diversity in our work force. We will create an environment that respects the individual, encourages leadership, stimulates innovation, fosters integrity, and demands excellence.

The foundations for Berkeley Lab Vision 2000 are the Laboratory's employees, operating resources and facilities infrastructure. The goal is to create an environment where diversity is valued, and where leadership and innovation are enabled. The Berkeley Lab Vision calls for integrated operational, technical and facilities resources that work seamlessly with the Laboratory's scientific and engineering programs. The goal is to make Berkeley Lab the location of choice for major new facilities and scientific programs.

Berkeley Lab Vision 2000 focuses on the Department of Energy as Berkeley Lab's primary sponsor but also recognizes the opportunity and need to support other national missions. The vision establishes a commitment to reach out and forge new partnerships with industry, academia, and other national laboratories to create value for the economy, enhance education, and contribute to the community. The vision also stresses the conduct of operations with full regard for environment, health, and safety.

Berkeley Lab Vision 2000, through its task forces and strategic planning process, commits the Laboratory to positive actions that will increase Berkeley Lab's competitiveness and ensure that the Laboratory continues to perform research of the highest scientific quality. To maintain the scientific leadership identified in Berkeley Lab Vision 2000, it will be necessary to develop and fully utilize the Laboratory's capabilities and resources, and to sustain quality programs in compliance with environmental and safety laws.

The CFP incorporates a ten-year plan and outlook for GPP, GPE, and MEL-FS that establishes priorities against quantitative CAMP criteria to meet programmatic, environmental, and safety needs forBerkeley Lab Vision 2000. The Laboratory will work with the OER and DOE/OAK to reconcile the discrepancy between past funding models and GPP and GPE resource needs. The coordination and funding of these programs at the PSO level provides a basis for implementing an effective capital resources planning and modernization program that works towards Vision 2000.

Planning Assumptions and Trends

The Strategic View identifies external conditions and future national research directions relevant to Laboratory programs. The planning assumptions and trends described below are in agreement with the Laboratory's current Institutional Plan.

Facilities-Management Implications. Maintaining the Laboratory's scientific leadership requires a sustained effort to revitalize the physical plant. The Laboratory's management seeks to provide an effective and efficient CFP covering the next two decades, which promise to be highly productive for research scientists and engineers. The institutional- and site-planning processes will continue to be management focal points for developing the Laboratory's supporting infrastructure and achieving its research goals.

Internal flexibility and coordination with national programs are essential for responding to opportunities and directing resources to the most scientifically promising areas. A critical Laboratory role is to inform the DOE of significant infrastructure needs and research opportunities. Berkeley Lab management will continue to strengthen the dialogue on capital asset needs.

The Laboratory will continue to place priority on new or improved facilities because these sustain national programs and provide an effective working environ-

ment. These facilities maintain vitality in the Laboratory, but, more importantly, they will also create new opportunities for collaboration with industry and the university communities.

Constrained budgets will continue to hinder Berkeley Lab's ability to manage its site. Every effort is made to assist the DOE in justifications and analysis that support continued and increased support for site and facilities improvements. Planning is based on estimates of future funding through close cooperation with DOE/OAK and Headquarters personnel.

Infrastructure for Users. Berkeley Lab has established focal points for graduate training and related educational support and for industry collaboration. These focal points include the Advanced Light Source, the National Center for Electron Microscopy, and the 88-Inch Cyclotron and other organizational units, such as the Human Genome Center, the Center for Advanced Materials, the Center for Building Science, CIEE, and the Center for X-Ray Optics. In the future, stronger levels of industry involvement are expected, and Berkeley Lab and the other national laboratories will continue to establish additional collaborative centers, industry fellowships, and industry-laboratory research contracts. The longer-term trend will be a reduction of barriers to cooperation between industry and government.

The increased number of visiting researchers will require construction of additional user facilities including parking facilities, food-service facilities, conference rooms, and work areas. Berkeley Lab will continue to work with DOE and with other government agencies to provide innovative funding mechanisms to meet these needs.

Fundamental and Applied Research. Basic research will continue to be supported strongly at the national level. Since Berkeley Lab primarily serves the DOE's basic-research programs, this strong support provides a constructive environment for Berkeley Lab initiatives that have a new and fundamental research focus. The national laboratories will retain their capability to contribute to the energy mission of the DOE through their basic-research capability and their proposals to develop and build new facilities that serve university and industrial research communities. At Berkeley Lab, future programs will emphasize the continued exploration of fundamental scientific and engineering questions that underlie, or lead to, new energy technologies.

The institutional planning process required of the national laboratories is one of the few formal and outwardly directed program-planning activities that takes place in DOE. At Berkeley Lab the SDP and CFP are coupled with the Institutional Plan and will continue to be a vital and primary mechanism to implement DOE goals and their relation to national scientific plans.

Future Programmatic Research Areas

The following sections identify important conditions affecting Berkeley Lab's Energy Sciences, General Sciences, and Biosciences programs. As indicated above, these programs will be limited by fiscal constraints associated with Federal budget-deficit-reduction efforts, and the overall levels of Laboratory activity and staffing are not expected to grow significantly. The long-term strengths of DOE programs for research and advanced technology will include closer collaboration with industry and an enlarged role in educational support.

The major programs to implement Berkeley Lab's mission are developed in response to DOE's national programs in the basic energy sciences, health and environmental research, high energy and nuclear physics, and energy efficiency and renewable energy.

In response to national needs for high-brightness synchrotron radiation facilities, Berkeley Lab has completed construction of the Advanced Light Source (ALS). The ALS provides the world's brightest beams of soft x-ray and ultraviolet light for use in materials science research, chemistry, biology, and other fields. The ALS provides ports for up to 55 end stations, including use by up to 200 guests at any one time. Berkeley Lab must provide the research and facilities infrastructure to support this user community.

Berkeley Lab, in coordination with other national laboratories, has prepared concep-

tual designs for a Chemical Dynamics Research Laboratory for advanced studies in reaction science and combustion chemistry. Other future projects include improvements to the National Center for Electron Microscopy, and strengthened programs in the Center for Advanced Materials and in the life sciences.

Energy Sciences. The scientific outlook for the Energy Sciences is affected by developments in many scientific fields, but especially research in energy supply and efficiency technologies and in chemistry, geology, materials science, and physics. The Laboratory views the following future research trends as important:

Energy-use research important to national energy security will emphasize advanced high-efficiency combustion, energy storage, electric lighting, energy-intensive chemical processes, and energy flows through walls and windows. Additional research facilities at Berkeley Lab would improve the ability to meet these research goals. Continued reliance on fossil fuels and nuclear power will intensify problems with emissions and waste disposal and will be subjects of study at the national and international level, including Eastern Europe and developing countries.

Materials science research growth areas will support key materials of national interest, including materials with reduced dimensionality, high-temperature superconductors, semiconductors, composites, ceramics, light alloys and polymers. The Berkeley Lab Advanced Light Source, Center for Advanced Materials, National Center for Electron Microscopy, and Center for X-Ray Optics will be important elements of a national program directed toward improved materials synthesis and processing, including advanced x-ray lithography.

Chemistry of inorganic and complex organic molecules will require advanced techniques using intense photon beams, nuclear magnetic resonance (NMR) spectroscopy, and laser spectroscopy. The defined programmatic needs for these techniques, including infrared free-electron laser facilities required for reactivity studies of molecular dynamics, is an important programmatic projection in the master plan.

Earth sciences research will include geophysical investigations of the continental crust and physical and chemical studies of geological materials, including petroleum and geothermal reservoirs, and processes involving the transport and transformation of chemicals in complex geological structures.

General Sciences. Berkeley Lab's general sciences programs are developed in conjunction with the high-energy and nuclear physics communities and with Federal programs in fusion research. New program-related projects represent no planned increase in building area. Berkeley Lab's general sciences includes the following developments:

Nuclear physics research will emphasize techniques that probe or alter the state of nuclei to explore nucleonic, hadronic, and quark-gluon matter. The national Gammasphere project at the Berkeley Lab 88-Inch Cyclotron is essential to understand the physics of nuclear structure. Collaborative experiments are being planned at the Relativistic Heavy Ion Collider under construction at Brookhaven National Laboratory (the STAR experiment collaboration).

Berkeley Lab will continue its high-energy physics research programs at the Tevatron and Stanford Linear Collider (SLC) and at the recently funded B-Factory upgrade at the Positron-Electron Project (PEP).

Berkeley Lab will continue its leading research in developing heavy-ion prototype accelerators for fusion in support of a technology that would ultimately employ accelerated beams of ions to ignite fusion fuel pellets. These research studies include Elise. (The fuel pellet research will be conducted by other laboratories.) The development of neutral beam testing facilities to evaluate supplemental plasma heating will continue in support of the magnetic-fusion program for the International Thermonuclear Experimental Reactor (ITER).

Biosciences. In health and environmental research, Berkeley Lab was designated by the Secretary of Energy in 1987 as a DOE Human Genome Center. Support for human genome research required an expansion of life-sciences-related facilities, and led to the construction of the Human Genome Laboratory now in progress. In addition, Berkeley Lab supports DOE's structural biology initiative through the Laboratory's ALS Structural Biology Support Facilities now being constructed in existing

buildings. Programmatic growth areas are the following:

Physical mapping and eventual sequencing of the human genome will be emphasized, including determination of human genome structure and expression, clonal library preparation, robotics, novel instrumentation, development of advanced computation and pattern-recognition techniques, and medical genetics.

Basic research in the molecular and cellular aspects of the control of gene expression, differentiation, DNA repair and carcinogenesis, and genomic stability in human as well as animal model systems will provide tools for an understanding of environmentally related disorders.

Structural biology research will be directed toward determining the relationship between the structure of biological macromolecules and their functions. The application of synchrotron radiation and advanced computational techniques will allow the determination of the three-dimensional structure of proteins and nucleic acids.

Biomedical research will continue the application of advanced technology to study, diagnose, and treat human disease through innovations in positron emission tomography (PET), NMR, and charged-particle radiation therapy and radiosurgery. A Biomedical Isotope Facility is under construction at an existing building to advance PET research.

Environmental and health-effects research will include atmospheric chemistry and transport, deposition, and ecological effects of combustion products. Studies of sources and transport of chemicals from the subsurface environment will cover contamination of groundwater, radon exposure and other pollutants. Research will include studies of potential global environmental changes.

Projected Trends. The most likely research trends would include several initiatives, primarily in DOE's Office of Energy Research. Some programs will grow substantially, such as materials science and structural biology research associated with the Advanced Light Source, chemical sciences research at the Chemical Dynamics Research laboratory, Human Genome Center research, and the Heavy Ion Fusion Accelerator Research program.

BERKELEY LAB PROGRAM INITIATIVES SUMMARY

Basic Energy Sciences
- Combustion Dynamics Initiative
- Advanced Light Source Beamlines Initiative
- Atomic Scale Synthesis of Advanced Materials
- Advanced Transmission Electron Microscopes
- High Performance Computing and Communications

High Energy and Nuclear Physics
- PEP II, An Asymmetric B Factory (at the Stanford Linear Accelerator Center, California)
- Relativistic Heavy-Ion Collider Program (at the Brookhaven National Laboratory, New York)

Health and Environmental Research
- Human Genome Laboratory
- Structural Biology Initiative
- Global Change Research Program

Energy Efficiency and Renewable Energy
- Advanced Energy Design and Operations Technologies

Domestic and International Energy Policy
- Assisting Deployment of Energy Practices and Technologies

Fusion Energy
- Elise
- Neutral Beam Test Facility for ITER

Environmental Restoration and Waste Management
- Environmental Restoration Research and Development

Work for Others
- Advanced Lithography Initiative
- Magnetic Materials Microscope

These trends indicate the continued development of Berkeley Lab as a multiprogram energy research laboratory with complementary research programs and supporting infrastructure. The proposed initiatives encompass the five-year planning period and span most of DOE's research program areas appropriate to this multiprogram national laboratory. These initiatives are identified in the Berkeley Lab Program Initiatives Summary.

Berkeley Lab has also projected a comprehensive, enhanced environmental restoration and waste management program. On global, regional, and local scales, strengthened environmental protection, improved waste management, and thorough safety practices are receiving increasing emphasis. DOE's national facilities are reviewing their policies and procedures to ensure full accountability and to set priorities to emphasize environment and safety. Berkeley Lab has been actively involved in the formulation of environmental protection and safety plans and programs for improved compliance.

Summary of Berkeley Lab Scientific Activities and Plans

A new major national user facility, the ALS, became available for qualified scientists from throughout the U.S. in April 1993. The facility will provide ultraviolet and soft x-ray (photon) beams of high spectral brightness, high flux, and partial coherence in pulses several picoseconds long. The ALS will serve many users from industry, academia, and other national laboratories and is the focus for redevelopment of the original Laboratory site in the Old Town area.

Berkeley Lab continues to initiate important new research programs requiring state of the art laboratory facilities and advanced accelerators and detectors. New experimental and fabrication facilities are being developed to support national high-energy physics and nuclear physics programs, for example. At Berkeley Lab these support facilities include construction of ultrahigh-vacuum facilities and clean rooms and the rehabilitation and expansion of high-bay space for detector assembly and fabrication.

Materials and chemistry research now constitutes a significant share of activity at Berkeley Lab. The proposed Chemical Dynamics Research Laboratory is an initiative that supports DOE's Basic Energy Science Programs. The Center for Advanced Materials has established programs that integrate materials research on synthesis, processing, characterization, and instrumentation development in collaboration with U.S. industry. The Center for X-Ray Optics develops sources of radiation and techniques to transport, focus, disperse, and detect soft x-rays in support of research in many fields.

Life sciences research is conducted in six major program areas: molecular genetics and nucleic acid studies, gene expression and physiology, nuclear medicine, carcinogenesis and mutagenesis, structural biology, and environmental research. Most of this research is conducted at the Donner Laboratory, at the Calvin Laboratory for chemical biodynamics on the UCB campus, and at the Berkeley Lab Life Sciences Research Area, where additional facilities for cell and molecular biology and human-genome research are needed.

Research in energy technology and energy conservation emphasizes potential new fusion-generation, electric-energy storage, and building systems. Examples include the evaluation of heavy-ion accelerators as drivers for inertial confinement fusion, new battery systems, and advanced concepts for fluorescent lamps. In the geosciences Berkeley Lab has several thrusts, including, for example, geochemistry of selenium contamination in reservoirs. Complementary sources of coherent radiation, including those in the visible- and infrared-wavelength regions are also being studied.

Additional facilities for advanced accelerator physics research, biotechnology development, heavy-ion physics experimentation, energy efficiency and supply, and advanced engineering-support activities are currently being planned or are being considered as possibilities for future development. The Laboratory expects the trend toward advanced instrumentation, improved computational capabilities, and multidisciplinary scientific programs to continue.

In the future the role of national laboratories as centers for research services to qualified users will grow to ensure the availability and efficient use of advanced research facilities. Beyond the 1990s the nation will continue to face increasing demands for research and technical training programs that improve technical and economic competitiveness. To provide the required technological innovation and scientific expertise, the Laboratory will emphasize fundamental research programs, advanced user facilities for the general scientific community, new educational and training activities, and increased interaction with industry. Figure 3-3 provides information on the sources of Berkeley Lab operating funds for the years 1980 to 1993. With this approach, the Laboratory's expertise and facilities will help meet national scientific and economic goals well into the next century.

This CFP is in agreement with the Laboratory's Five-Year Institutional Plan and in conformance with the LRDP approved by The UC Regents in 1987 and with the Supplemental Environmental Impact Report (SEIR) approved in 1992. It incorporates a framework for long-range development that provides for flexibility in siting and protection of the environment and natural resources.

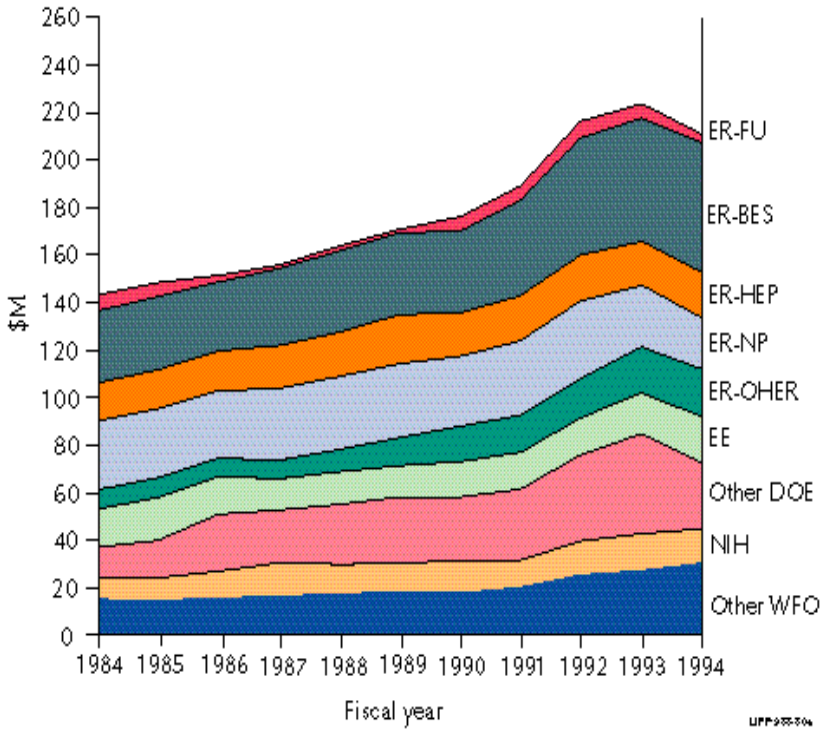


Fig. 3-3. Sources of Berkeley Lab opereating funds from 1984 to 1994.

Resource Projections

Resource projections for the next 5 years are found in Table 3-1. Operating budgets are expected to be relatively stable, consistent with Federal budget trends, and increases in construction funding to accomplish the SDP goals are included. Specific information on resource projections is based on Berkeley Lab's *FY 1994–1999 Institutional Plan* (PUB-5379).

Table 3-1. Resource Projections (Fiscal Year/Full-Time Employees).

Category	1987	1988	1989	1990	1991	1992	1993	1994
DOE Direct	1487	1514	1445	1356	1366	1375	1383	1391
WFO	279	287	304	305	307	308	296	283
Total Direct	**1766**	**1801**	**1749**	**1662**	**1673**	**1683**	**1679**	**1674**
Total Indirect	**737**	**762**	**759**	**741**	**741**	**741**	**742**	**742**
Total Lab Personnel	**2503**	**2563**	**2508**	**2403**	**2414**	**2424**	**2420**	**2416**

SITE ASSESSMENT—EXISTING CONDITIONS

Background

Berkeley Lab's facility-related problems stem from the obsolete design of its oldest buildings, deteriorating utilities, and the changes in scientific needs since 1940. Many laboratories and shops were originally designed for temporary service during World War II. Figure 3-4 shows the age distribution of main-site buildings. In addition, some buildings constructed during 1940–1960 are not adequate for today's highly technological scientific demands.

Berkeley Lab has developed site assessment planning programs to identify building needs and to integrate facility maintenance

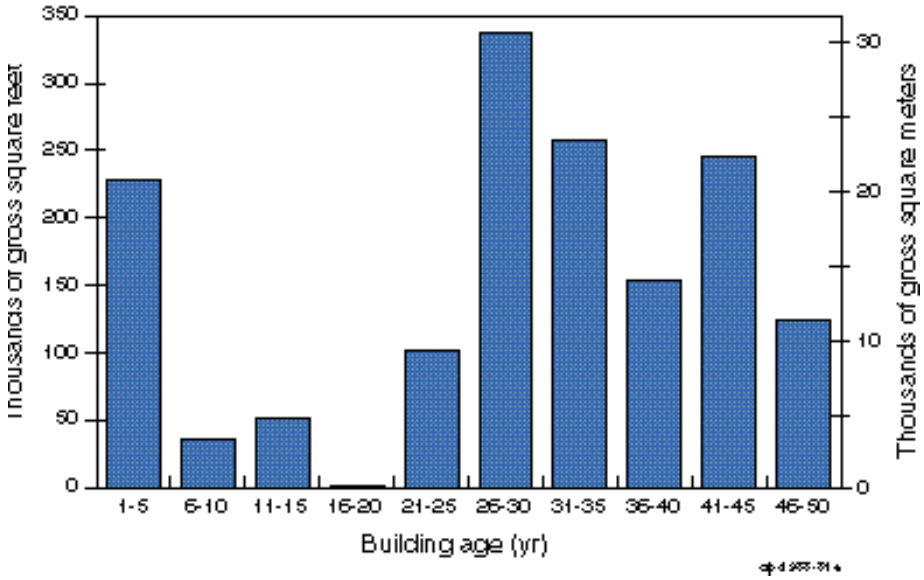


Fig. 3-4. Age distribution of main-site buildings.

and improvement projects. Berkeley Lab evaluates its projects using Capital Asset Management planning criteria and performs assessments of facilities consistent with the goals of the DOE's planned Conditions Assessment Survey goals.

The shop and support facilities, which provide services such as environmental control (e.g., airborne particle concentrations) and utilities, must be appropriate to current research programs. Electrical utilities projects are identified in Table 3-2. Forecasts for electricity and natural gas are shown in Table 3-3. Analysis by types of electrical service is presented in Table 3-4. An analysis of building conditions by type of space is presented in Figure 3-5.

Table 3-2. Planned Electrical Utility Improvements.

Functional Area	Existing			Planned		
	Xformer (no.)	Switch (no.)	Cable (miles)	Xformer (no.)	Switch (no.)	Cable (miles)
88-Inch Cyclotron Research Area	3	4	2	3	5	2
Central Research and Administration Area	7	12	3.75	8	24	2.75
Bevalac Accelerator Complex	20	45	12.5	20	49	17.5
Light Source Research and Engineering Area	19	30	5	18	45	8
Shops and Support Facilities Area	2	30	1	4	32	2
Materials and Chemistry Research Area	2	2	1	3	8	3.25
Life Sciences Research Area	1	1	0.75	5	16	1.25

Table 3-3. Electricity and Natural Gas Forecasts by Functional Area.

Functional Area	Electricity				Natural Gas			
	1995		2005		1995		2005	
	Area (gsf)	Usage (kWH)[a]	Area (gsf)	Usage (kWH)[a]	Area (gsf)	Usage (therms)[b]	Area (gsf)	Usage (therms)[b]
88-Inch Cyclotron Research Area	53,800	2,690,000	62,400	3,120,000	53,800	67,250	62,400	78,000
Central Research and Administration Area	493,380	24,669,000	500,950	25,047,500	493,380	616,725	500,950	626,187
Bevalac Accelerator Complex	352,400	0	471,900	0	352,400	0	471,900	0
Light Source Research and Engineering Area	409,510	20,475,500	498,070	24,903,500	409,510	511,887	498,070	622,587
Shops and Support Facilities Area	204,160	10,208,000	205,850	10,292,500	204,160	255,200	205,850	257,312
Materials and Chemistry Research Area	127,000	6,350,000	158,010	7,900,500	127,000	158,750	158,010	197,512
Life Sciences Research Area	98,700	4,935,000	147,910	7,395,500	98,700	123,375	147,910	184,887
TOTALS	**1,738,950**	**69,327,500**	**2,045,090**	**78,659,500**	**1,738,950**	**1,733,187**	**2,045,090**	**1,966,485**

[a]Based on average usage of 50 kWH/gsf
[b]Based on average usage of 1.25 therm/gsf

Table 3-4. Future Electrical Utilities by Type of Services.

Bldg / Description	Bank 1	Bank 1	Switchable	High Reliability
88-Inch Cyclotron Research Area				
All Buildings		•		•
Central Research and Administration Area				
50 Complex			•	•
54 Cafeteria			•	
55 Research Medicine		•		
70 Complex			•	
90 Complex			•	
Bevalac Accelerator Complex				
46/47 Complex			•	
51 Bevatron Accelerator	•	•		
58 Complex			•	
64 Accelerator Research	•			
71 Complex Hilac	•		•	
Light Source Research and Engineering Area				
2 Advanced Materials Lab		•		
4 & 5 Magnetic Fusion Energy	•	•	•	•
6 Advanced Light Source	•	•	•	•
10 Biology Research / Photo Lab	•	•	•	•
16 Magnetic Fusion Energy Lab		•		
25 Complex			•	
26 Medical Services		•		
37 Utilities and Service		•		
45 & 48 Fire Station	•	•	•	•
80 Center for X-Ray Optics	•	•	•	•
Shops and Support Facilities Area				
All Buildings			•	
Materials and Chemistry Research Area				
All Buildings			•	
Life Sciences Research Area				
All Buildings			•	

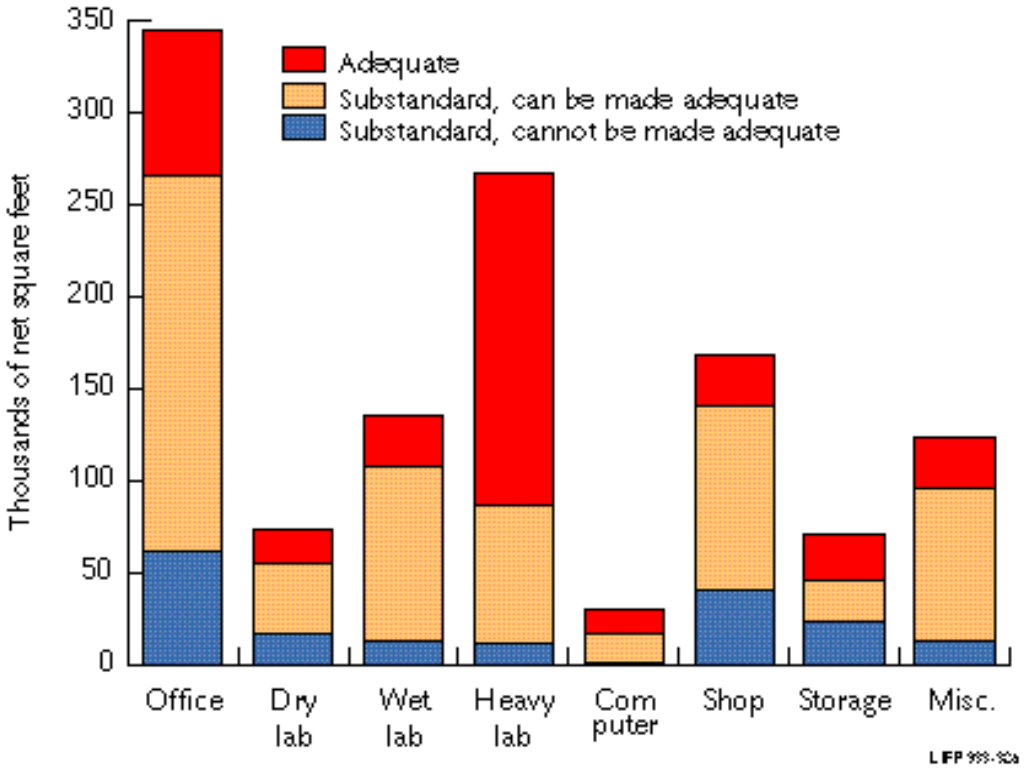


Fig. 3-5. Current space usage.

As described in Chapter 4, the Laboratory has developed a rehabilitation and replacement program with a long-range schedule. The largest costs are for building and utilities rehabilitation or replacement (see Chapter 4, Table 4-1).

Other projects include environmental and health projects, roadway safety improvements, and slope stabilization. The costs of the general-purpose facilities rehabilitation program for the FY 1993–2008 planning period are included in the construction cost table provided in Chapter 4.

Multiprogram Energy Laboratory Facilities Support (MEL-FS)

The MEL-FS program is vital for rehabilitating the Laboratory's deteriorated utility system and for modernizing, upgrading, and replacing obsolete facilities. The MEL-FS project priorities and schedule are prepared following careful planning and review by Laboratory management. The long-range profile is driven by budget constraints; for example, those utility projects scheduled to begin in 5–10 years correct existing, not future, problems.

General Plant Projects (GPP)

The GPP program can provide a timely mechanism to fund priority projects; however, the amount of funds received have been inadequate to meet the Laboratory's needs. Berkeley Lab has developed site assessment planning programs to identify building needs

and to integrate facility maintenance will require significant GPP outlays for the significant improvements—such as fire and life safety improvements, 12-kV cabling upgrades, new radio communication system towers, new conduit extensions, and small building modifications and additions—needed over the next several years. Progress in increasing GPP funds is important to the success of the Laboratory's rehabilitation program.

Utility Needs

Many of the Laboratory's utility systems were sized to serve the Laboratory's large accelerators, and have the capacity to fulfill present and future electrical, gas, water, cooling, and waste requirements. However, many segments and load centers in the utility systems are aged and require rehabilitation to improve flexibility and reliability (see Figures 3-6 and 3-7). The utility systems that are undergoing rehabilitation include natural gas, potable water, cooling water, low-conductivity water, electrical power, sanitary sewers, compressed air, storm drains, standby electricity, and alarm and security. New building construction (see Figure 3-8) will require some new utility corridors to link existing east- and west-site utilities. New corridors are being developed within the Light Source Research and Engineering Area, and extensions are needed to the Life Sciences Research Area. In general, these will include electric service as well as water and gas lines, sanitary

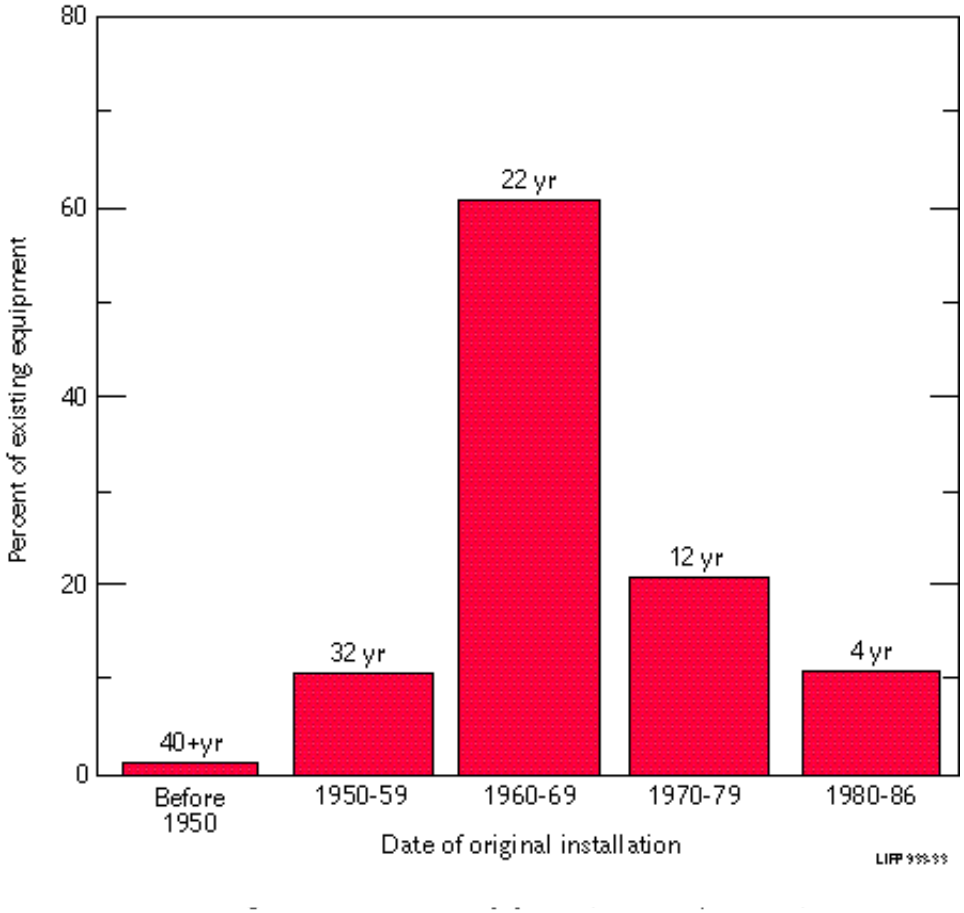


Fig. 3-6. Age of Berkeley Lab mechanical equipment (reference year 1987).

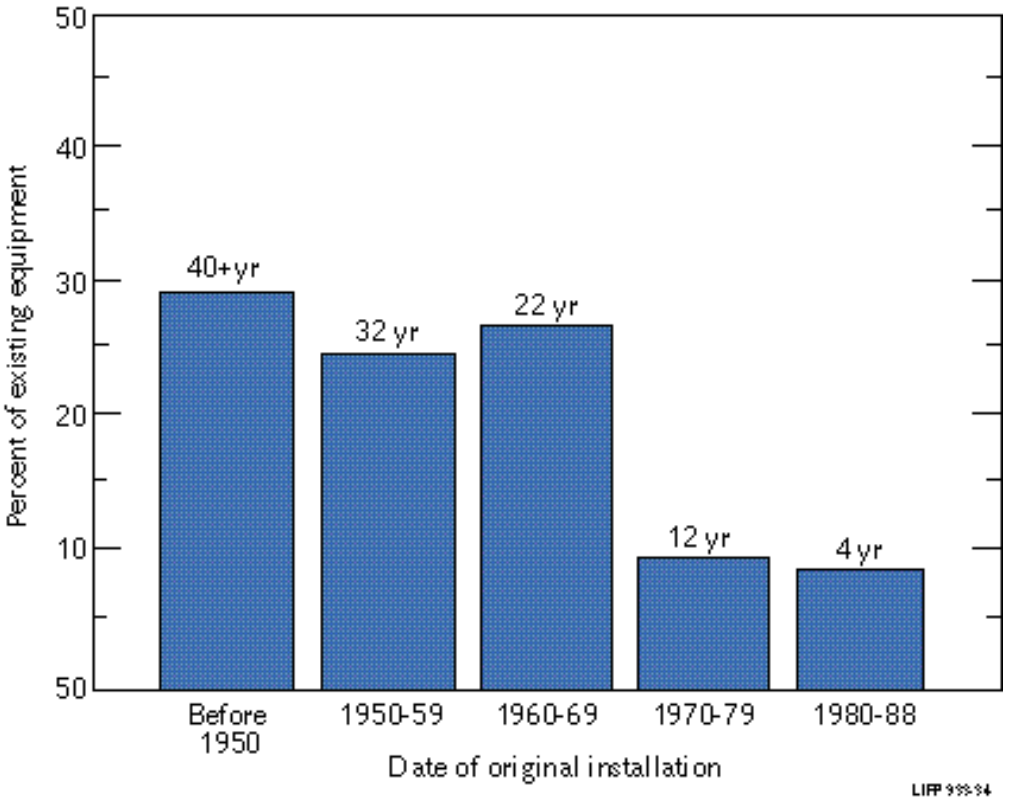


Fig. 3-7. Age of Berkeley Lab electrical equipment.

sewers, and storm drains. Electrical, communication, and fire-alarm systems are shown in Figure 3-9. For existing and planned utility utilization for water, sewer, natural gas, and electricity see Tables 2-6 through 2-9.

The Berkeley Lab electrical distribution system must be able to cope with power interruptions while providing standby power to those Berkeley Lab facilities that cannot tolerate interruptions. The basic elements for a flexible and reliable Berkeley Lab distribution system exist already, however, and a cost-effective rehabilitation can be accomplished at a fraction of the replacement value of the existing system.

The multiphase rehabilitation program of the 12-kV electrical power distribution system involves replacement of aging and hazardous switching equipment and distribution cables. The existing single-service radial distribution system is being expanded to a double-bus distribution system by extending the existing central double-bus system at the Grizzly main substation to seven centrally located switching stations. From these switching stations double feeder circuits will be extended to Laboratory buildings and other facilities. This arrangement will restrict electrical system failures to fewer facilities, reduce unplanned outages, and enhance preventive maintenance activities.

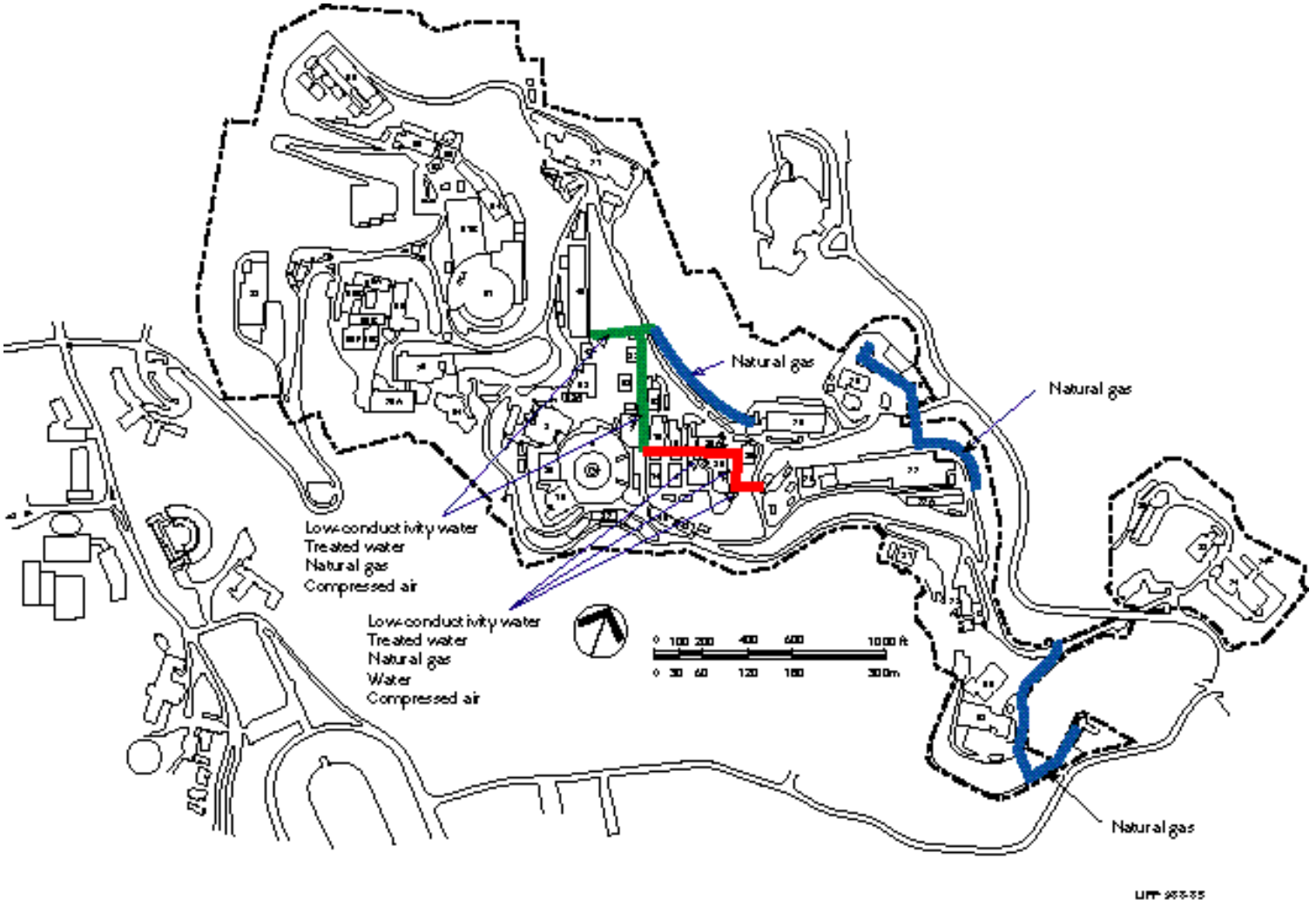


Fig. 3-8. Mechanical utility corridor improvements.

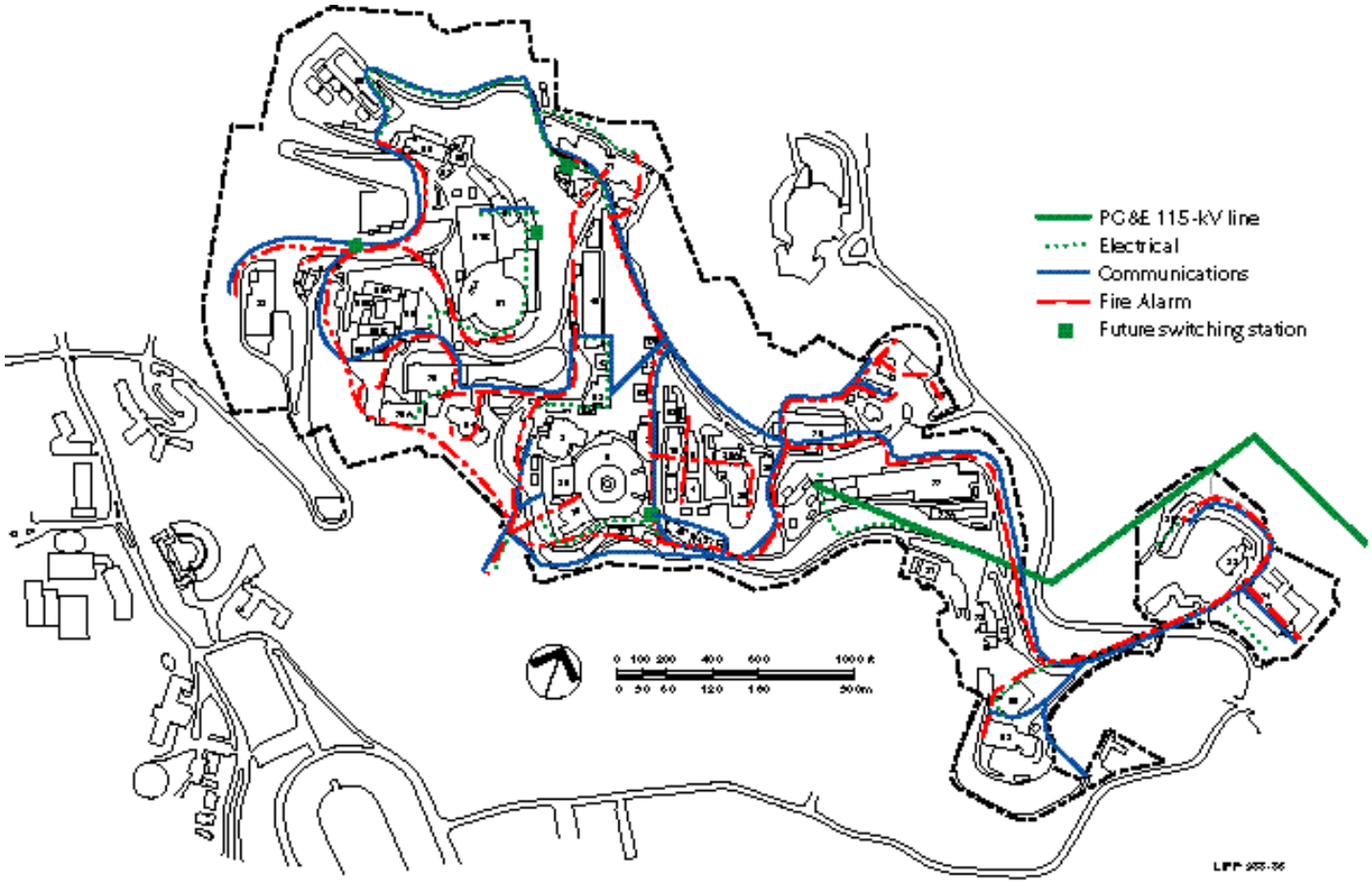


Fig. 3-9. Electrical, communications, and fire-alarm improvements.

New buildings and other energy-using facilities will incorporate energy efficiency features that meet or exceed applicable Federal energy use standards, incorporating cost-effective, energy-efficient designs whenever possible. Design of major facilities such as new cooling towers and building HVAC and lighting systems will be optimized for energy efficiency and placed under the Energy Management Control System. Also, natural gas and electricity will be metered to provide data for identifying energy waste and for establishing priorities for potential energy retrofit projects.

Rehabilitation of mechanical utilities is required at several locations for potable water, cooling water, compressed air, natural gas, storm drain, sanitary sewer, and acid waste systems. Portions of the outdated potable water piping, as well as valves, backflow preventers, fire sprinkler risers, and obsolete fire hydrants, will be replaced. The cooling water system in several buildings will be rehabilitated. Security improvements will include renewal and extension of the card-key system and improvements to the fire alarm network.

Maintenance Needs

The Laboratory is formulating integrated plans for long-range capital improvements and operating expenditures. Berkeley Lab is working with DOE to integrate the goals of the condition assessment survey and the capital asset management program into Berkeley Lab's maintenance planning and project development planning.

MEL-FS projects include replacement and rehabilitation of facilities to maintain existing capability. MEL-FS funds have been used to replace roofs, paving, electrical systems, underground utilities, and mechanical systems. As MEL-FS projects have been delayed there is increasing pressure to address the most pressing portions of the proposed projects using GPP funds (where discrete projects can be defined). This trend could have very serious implications for the Laboratory's ability to efficiently manage its GPP needs.

Slope-stability projects have been identified and prioritized. Funding for these projects will be requested from both MEL-FS and GPP sources depending on the scope of work. Priorities are based on potential threats to DOE structures, roads, and utility systems and on integration into the ongoing maintenance plan.

The operating expenses for maintenance include physical plant maintenance and noncapital alterations related to maintenance. Maintenance can be effectively managed by establishing priorities for maintenance projects and by replacing obsolete and high maintenance-cost facilities with modern facilities and equipment. Laboratory management is directing its efforts toward rehabilitation of buildings with MEL-FS funds. As these projects have been delayed and equipment that was formerly replaced with GPE funds no longer qualifies for this funding option, there is an increasing backlog in this sector. Increased DOE support would allow the maintenance and infrastructure backlogs to be effectively reduced within the next 10 years. The use of noncapital funds could then be efficiently allocated to maintain essential building and equipment investments.

SITE ASSESSMENT—FUTURE DEVELOPMENT

Planning is vital to the Laboratory's programs because of the need to use land efficiently, to replace obsolete facilities, and to plan for new construction within a realistic economic framework. In addition to program needs, land use decisions at Berkeley Lab involve consideration of a wide range of factors such as:

- Pedestrian and vehicular circulation
- Development scale and visibility
- Landscape context
- Social/recreational aspects
- Environmental factors
- Views
- Fire and erosion control
- Surface and ground water drainage
- Proximity to related activities
- Maintenance resources

Future Needs

Shortages of both laboratory and office space at Berkeley Lab have remained acute over the last 10 years, impeding the progress of scientific research and adding significant operational costs for interim solutions to these shortages. Planning for improved operational efficiency and significant future growth of the Laboratory focuses on three functional planning areas:

- Redevelopment of the original laboratory site now known as the Light Source Research and Engineering Area (Planning Area 4).
- Offices and support facilities for Berkeley Lab infrastructure primarily in the Shop and Support Facilities Area (Planning Area 5).
- Expansion in the Life Sciences Research Area (Planning Area 7).

Planning Area 4. The Light Source Research and Engineering Area, frequently referred to as 'Old Town', covers about 6 hectares (15 acres) and presents great potential for significant growth through redevelopment. The site has a central location, good geotechnical qualities, and natural topography suited to building sites for high-technology facilities.

Most of Area 4's existing buildings are old, inefficient, one-story structures that have been evaluated as "substandard, cannot be made adequate" (1987 Berkeley Lab Long Range Development Plan, Appendix B). Vehicle and pedestrian routes in the Area are also substandard, being narrow, indirect, and, in several places, hazardous. Although utility systems and load centers have ample capacity, they are generally aged and inflexible. The pressing need to replace or rehabilitate much of the existing infrastructure in Planning Area 4, coupled with physical attributes and central location, makes the Area a prime candidate for redevelopment.

Planning Area 5. The Shop and Support Facilities Area provides inadequate support for current EH&S and Facilities Department functions. Limitations have been identified through the 1991 Tiger Team assessment. Detailed programming analysis indicates that important functions are not being performed and the consolidation of existing space and activities is required.

Among the support needs are upgrades for scientific engineering facilities. The Laboratory has become increasingly active and successful in the fabrication of high technology systems and precision windings for large detectors in support of DOE programs at Berkeley Lab and at other national laboratories. This success has generated needs for upgraded shop assembly and staging space environmentally designed for high technology fabrication.

Planning Area 7. Recent consultant studies indicate that the Life Sciences Research Area has potential for significant additional develop-

ment. Expansion in biotechnology programs, such as the effort to map the human genome, can be accommodated in this Area while also maintaining outdoor environmental quality and providing sufficient parking.

Other major needs at Berkeley Lab are for multi-purpose office space and special light-laboratory and testing space to accommodate current multi-programmatic activities. The shortage of office space has resulted in serious crowding and the continued use of converted laboratory space and inefficient, expensive trailers. Table 3-5 provides an analysis of conditions by functional area, and Appendix D details planned additions and removals. Table 3-6 summarizes general-purpose building needs.

Since 1982, Berkeley Lab has been able to eliminate approximately 4,645 gsm (50,000 gsf) of off-site leased office space, primarily as a result of personnel reductions combined with consolidation of personnel in existing office space and trailers. However, for the short term, administrative functions are being relocated to 1,070 gsm (11,500 gsf) of leased space in downtown Berkeley, and 615 gsm (6,600 gsf) have been added to the life science program's leased area in the Berkeley Business Park. A major goal of the CFP is to provide space for essential safety, health, environmental, engineering, and maintenance functions. New laboratory space and lower-cost office additions will allow laboratories now used for offices to be reclaimed.

Table 3-5. Analysis of Building Conditions (gsf).

Area name	Adequate space	Substandard Can Be Made Adequate	Substandard Cannot Be Made Adequate
88-Inch Cyclotron Area	51,650	0	180
Central Research and Administration Area	48,210	413,010	24,710
Bevalac Accelerator Complex	183,860	136,860	37,360
Light Source Research and Eng. Area	132,900	130,750	133,950
Shops and Support Facilities Area	54,820	102,230	16,910
Materials and Chemical Research Area	62,390	59,570	2,050
Life Sciences Research Area	10,660	45,360	1,610
Total[a]	**544,500**	**887,800**	**216,700**

[a]Totals are rounded to nearest 100.

Table 3-6. General-Purpose Building Needs Summary.

Functional Need/Problem	Deficiency	Existing Requirements	Proposed Building
Workplace safety fire safety Environmental protection	Congested operations Substandard woodframing Inadequate chemical storage	42,000 gsf of office, light lab, and materials-handling and storage space	Safety and Support Services Facility
EH&S requirements Monitoring requirements Industrial hygiene	Insufficient space Inadequate/no labs No training areas	33,000 gsf of office light lab, training library and conference space	Environment Monitoring and Industrial Hygiene Building
Project management construction and maintenance facilities planning	Inadequate space Insufficient space temporary quarters	30,000 gsf of office space, records, conference areas in proximity to shops	Facilities Management Addition
Applied Science Energy research modernization	Temporary structures code compliance consolidation	20,000 gsf of light laboratories and offices	Applied Science Building/Replacement
Science education visitors	Insufficient space temporary structures	10,000 gsf of offices and conference areas	Science Education and Visitors Center
Seismic safety Fire safety Environmental protection Obsolete utilities	Unreinforced masonry Substandard grounding Drain and plumbing, hoods Substandard electrical service	40,000 gsf shop, office & light assembly, and high bay w/full utilities	Engineering Replacement Project Phase I
Workplace safety Fire safety Environmental protection Obsolete utilities	Uncontrolled ventilation Substandard grounding Inadequate plumbing substandard electrical service	40,000 gsf shop and office building w/full utilities	Engineering Replacement Project Phase II
Total General-Purpose Building Needs		235,000 gsf[a]	

[a]General-Purpose Building Construction will be offset with removals and demolition, resulting in generally constant net Berkeley Lab space.

Site Planning Concepts, Objectives, and Guidelines

Concepts. To guide development at the Laboratory, Berkeley Lab has developed the following planning concepts. These are based on long range institutional goals supportive of Berkeley Lab's mission.

- Provide outstanding research facilities and the flexibility to accommodate change required for national scientific needs.
- Protect the environment, provide site amenities, and buffer activities from adjacent populations.
- Ensure a safe, healthful, and attractive workplace; improve access and communication with the University community, and provide transportation and parking systems for employees and visitors.
- Protect and sustain the investment in valuable government-owned research and support facilities.
- Improve support and research services through consolidation and proper siting of functions.
- Promote energy conservation and cost economies through efficient design, location, operation, and maintenance.

Objectives. To implement the concepts, Berkeley Lab has defined five specific objectives. These objectives accommodate the Laboratory's facilities requirements within the site's physical, environmental, and operational conditions. The objectives provide a basis for understanding and evaluating the more detailed elements of the site plan, such as specific buildings, utilities, and transportation elements. The site planning objectives are:

- Consolidate activities within seven functional planning areas to enhance interaction and efficiency (Figure 3-10).
- Redevelop obsolete buildings and infrastructure, eliminate use of trailers for permanent functions, and improve building arrangements to increase landscape space in the original laboratory area.
- Coordinate development along the main east-west circulation axis (Figure 3-11), extending from Planning Area 1 to Planning Area 7, to eliminate vehicular system hazards, develop off-road parking, and improve the system of pedestrian pathways.
- Improve and maintain overall environmental quality and the site's natural beauty, by reforestation, landscape rehabilitation, and avoiding construction in highly valued landscape areas.
- Provide off-site locations for receiving, warehousing, and other support and research activities suited to decentralized locations.

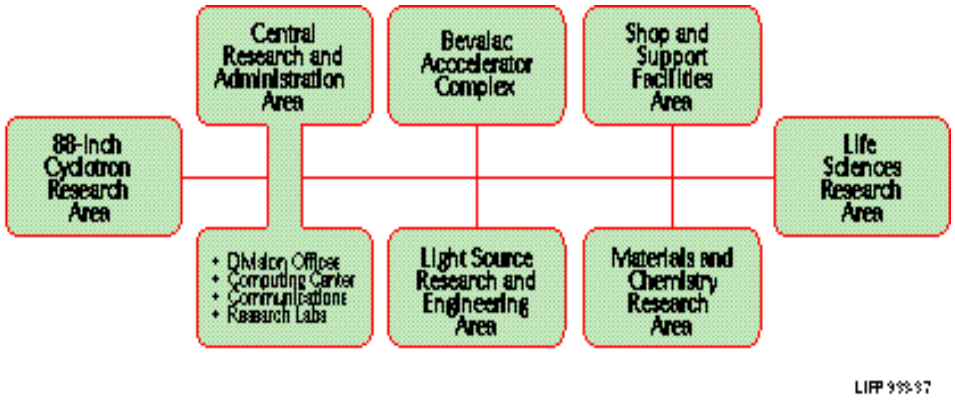
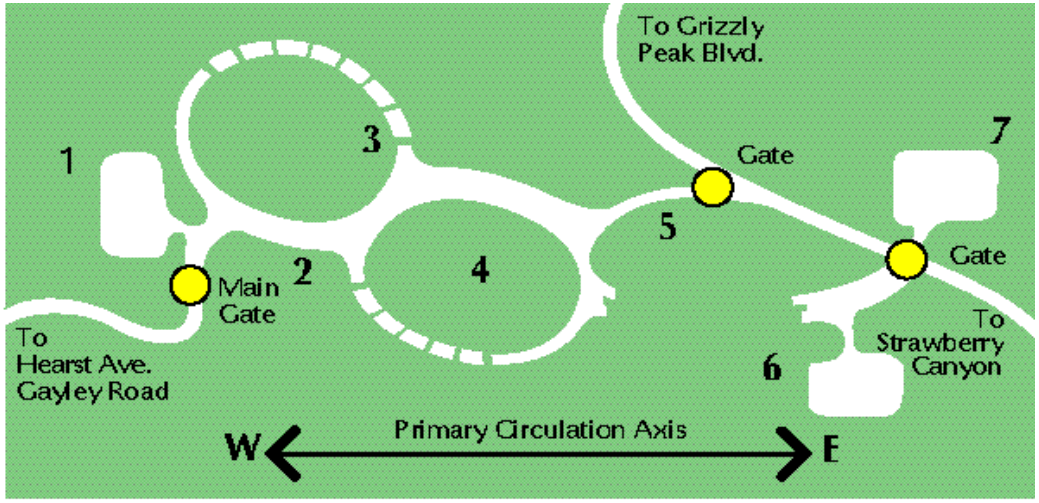


Fig. 3-10. Schematic concept of the seven functional planning areas.



NOTE: This is a schematic representation and is not to scale.

Fig. 3-11. The east-west circulation axis.

Guidelines. Berkeley Lab has instituted design guidelines to ensure that Laboratory development respects site constraints and provides coherence among building elements and the landscape. These guidelines address the following areas:

- *Safety Considerations.* New and rehabilitated buildings will conform with applicable federal, state, and local code requirements to safeguard the staff and the community.
- *Utilities Corridors*. Utility distribution systems are, where feasible, to be placed in trenches and under roadways. Central and localized distribution stations and feeder lines are located and sized for future building locations and anticipated demand. They will be subject to design reviews for compatibility with general site developments and future site needs.
- *Utility Centers*. Utility centers that serve more than one building will be located in zones that are dedicated to utilities and that are not suitable for building development. They will consolidate and centralize mechanical and electrical equipment such as cooling towers, chillers and pumps. Equipment will be sized separately for each building and interconnected in parallel so the system can respond efficiently to variable demand, from partial to full load.
- *Building Mass, Orientation, and Exteriors.* Buildings are to be designed to fit well into the slope of the land, to conserve important landscape features and open space, and to be closely integrated with the landscape plan. They are to be no more than five stories high and may not present an uninterrupted wall greater than four stories high. Exteriors of buildings are to be compatible in design with surrounding building elements and landscaping. Textures and colors, including those of roofs, are to be unobtrusive.
- *Energy and Operational Efficiency*. Buildings are to employ optimum energy efficiency strategies and efficiency features, including building orientation, natural illumination and daylighting control, and automated ventilation and climate-control systems, where feasible. In addition, building design considerations include efficiencies in maintainability of systems.
- *Building Use Flexibility.* Building circulation and utility systems are to provide flexible and modular space to allow for changes.

- *Circulation and Parking*. Circulation and parking plans are to provide compatibility between vehicle use and pedestrian safety. Pedestrian paths are to be separated from vehicles, where practicable, with distinct access and termination points so that bus stops, parking areas, loading docks, and building entrances are safe and efficient. Emergency vehicle and handicap access is to be incorporated into building and circulation design. Shuttle-bus stops are provided with shelters.
- *Topography and Grading*. Grading and retaining walls are to contribute to the stability of slopes and soils, to allow for smooth topographic transition between hillsides and structures, and to be constructed of materials visually suitable for their locations. Design solutions shall minimize grading and the height of retaining walls.
- *Landscaping and Open Space*. Landscaping, along with designated open space, contributes to the compatibility of buildings with hillside vegetation. It visually screens service areas, reduces fire danger, contributes to slope stability, provides summer shade, and creates new areas for the use and enjoyment of employees and visitors. Existing natural landscaping is to be preserved to the extent possible.
- *Review Process.* Detailed design guidelines are to be established for each development site before design begins. Each project will be reviewed for conformance to these guidelines by the Laboratory's architects and engineers and by the Director's Architectural Consultant.

Development Constraints and Opportunities

Constraints. Most of Berkeley Lab's extensive open space lands have particular environmental sensitivities that limit development opportunities. The sensitive factors involved include steep and unstable slopes, important views of the Bay, geology, hydrology, and valuable vegetation (Table 2-5).

A recent study of potential development sites at Berkeley Lab mapped the constraints imposed by such environmental sensitivities (Figure 3-12). Utility 'corridors' encompassing three or more utility lines are included as a constraint to future development because of the significant expense involved in rerouting. The visibility of large portions of the Laboratory site also constrains future development potential. Where site constraints overlap, the difficulty of development increases. As no currently undeveloped area of the site is without constraints, planning for future growth must carefully evaluate development proposals in light of Berkeley Lab's stated site concepts, objectives, and guidelines.

Opportunities. A mapping of areas suitable for development (Figure 3-13) illustrates the limited extent of undeveloped Berkeley Lab property which meets planning criteria, including functional proximity. Existing development areas are least constrained, indicating that redevelopment of substandard buildings offers opportunity for Laboratory growth. Area 7 presents one of the few locations suitable for extensive new Laboratory expansion.

Several areas immediately adjacent to Berkeley Lab also offer potential for development (Figure 3-13). These locations have passed an initial gross screening that considered the constraints and desirability of all lands adjacent to the Berkeley Lab fence line. Several areas warrant further discussion and possible study in light of Berkeley Lab's existing site constraints and need to respond to national needs for new research capability and facilities.

Needs and Site Capabilities

An analysis of the constraints and opportunities for future development and redevelopment of the Berkeley Lab site has focused long-range planning on site potential (or build-out) for comparison with long-range program needs. Subportions of the site with potential for cost-effective development (or redevelopment) have been targeted for study in greater detail.

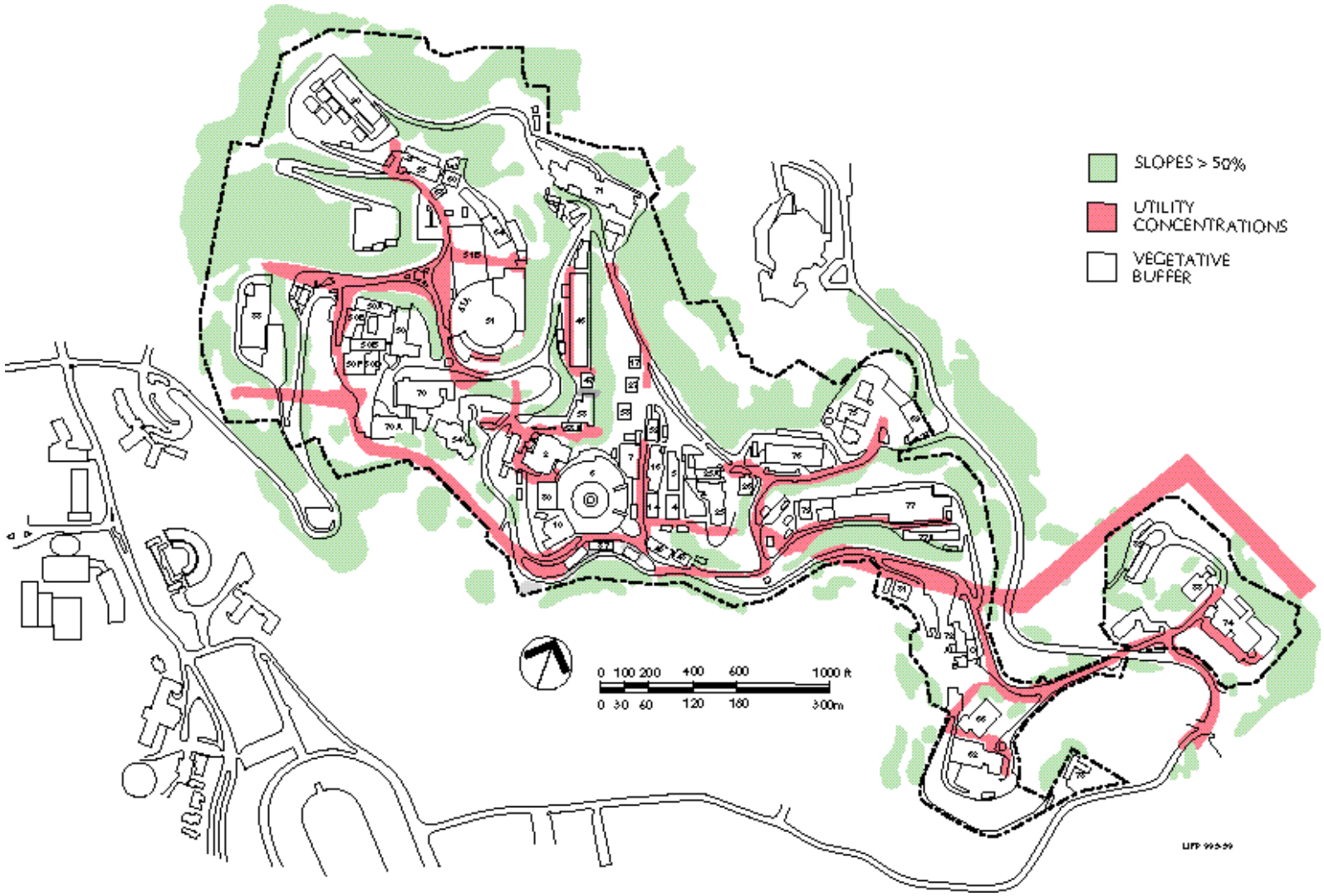


Fig. 3-12. Constraints to buildability.

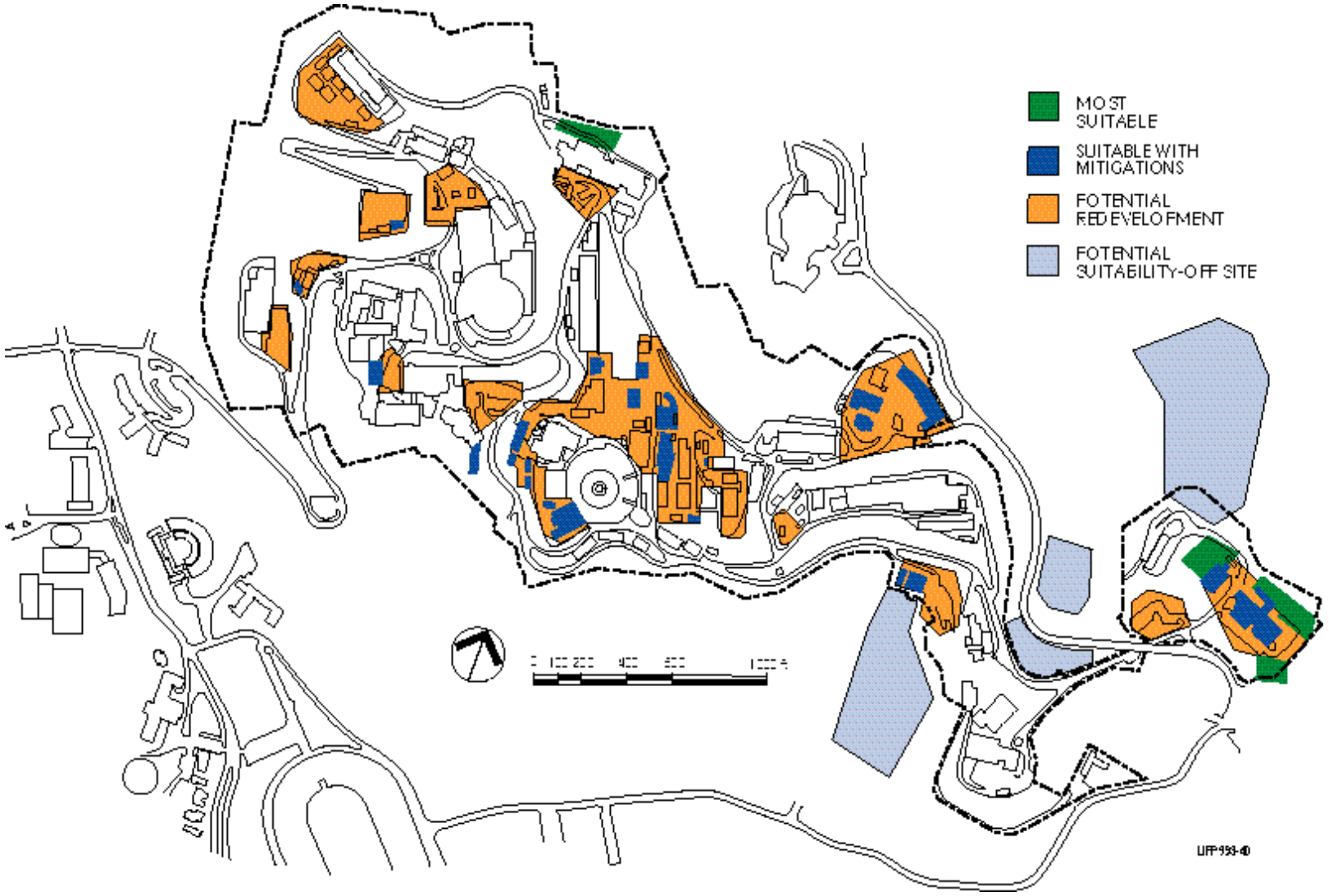


Fig. 3-13. Development suitability.

Comprehensive site use studies have been made to ensure the most efficient and most cost-effective use of available sites. In parallel, the Laboratory has studied the need for additional facilities beyond the 5-year institutional planning period on the basis of potential program initiatives.

Construction of all the projects represented in this plan would result in a net increase of approximately 37,600 gsm (405,000 gsf) of buildings in the main Laboratory site, for a total of 190,000 gsm (2,045,090 gsf). For comparison, the 1992 total is 150,600 gsm (1,621,100 gsf) (see Appendix C).

This increased need results from the increased development of programs in materials science and chemistry, earth sciences, energy efficiency and renewable energy, and fossil energy that were not a part of the Laboratory's mission in the early 1960s.

In addition, the specialized research facilities and program expansion in the physical sciences and the life sciences, such as electron microscopy and molecular genetics, and new facilities for the Advanced Light Source were not anticipated in the 1960s and have required, or will require, new buildings or extensive additions to existing buildings.

The CFP also emphasizes utility rehabilitation, improved parking and traffic circulation, and respect for nine landscape buffer areas that unify the site and provide compatibility with the surrounding hillside. The major site-development proposals are (1) infrastructure and space improvements for support functions (2) redevelop the original Laboratory site to eliminate obsolete buildings and enhance the open space, (3) expand the Life Sciences area by acres, and (4) eliminate the use of 60,000 gsf of trailers. The SDP allows for a Laboratory staff size of 4,750 at all existing activity areas.

Conclusions

The environmental consequences of development have been studied, including cumulative effects related to traffic and parking. Consequently, a population of 4,750 represents a realistic long-term development level. Because there is room for physical alternatives in the long term, care has been taken to establish and preserve areas adjacent to existing facilities to permit future development.

About 50% of Berkeley Lab's estimated maximum population growth is projected to take place during the next five-year institutional planning period, during which time the total Lab population will increase from 3,940 to 4,390 (including visitors). Over the long term the total population (including visitors) will level off at 4,750. This development level has been based upon conditions governed by geographical, environmental, and research factors. The main-site projected population for the Institutional Plan five-year period is 3,590; for the long-range 20-Year Master Plan period, 4,100.

Solutions incorporated into the redevelopment plan are designed for mission-oriented

functional relationships, but the plan also preserves a character appropriate to a highly visible and sensitive hillside area in an urban setting. Proposed building sizes and locations for research initiatives yet unknown have been selected to enhance modular development and flexibility.

Site and facility requirements to carry out program goals and related multiprogram support activities have been developed in conceptual designs for individual projects. New construction, renovations, removals, corrections, and other means to fulfill projected program activities are translated into funding requirements and compared with personnel projections (Table 3-1).

Background studies and plans that have been carried out in support of this planning analysis are listed in Appendix A.

FUNCTIONAL UNIT LIFE CYCLE PLANS

This section includes life cycle plans for the 21 functional units that have been used at Berkeley Lab. Table 3-7 summarizes the life cycle plans for these functional units in three broad classes, building space; site improvements, utilities, and communications; and accelerators and other equipment.

Table 3-7. Life Cycle Plans Summary.

Functional Unit	# Assets	Original* Cost ($M)	RPV ($M)	Total GSF
A. BUILDING SPACE				
10 ADMINISTRATIVE				
Berkeley Lab-Site, DOE-owned Blds	12	8.67	68.41	228,028
Berkeley Lab Site, DOE-owned trlrs	42	1.42	10.95	45,608
Off-Site, Leased	2	0.00	9.75	32,509
Subtotals	56	10.09	89.11	306,145
12 STORAGE				
Berkeley Lab-Site, DOE-owned Blds	5	0.82	9.07	36,280
Berkeley Lab Site, DOE-owned Trlrs	2	0.00	0.36	1,485
Off-Site, Leased	2	0.00	24.12	96,482
Subtotals	9	0.82	33.55	134,247
14 SERVICE				
Berkeley Lab Site, DOE-owned Blds	12	9.66	56.04	160,122
Berkeley Lab-Site, DOE-owned Trlrs	1	0.00	0.12	512
Berkeley Lab-Site, UC-Owned	1	0.00	2.12	6,060
Subtotals	14	9.66	58.29	166,694
15 RSCH & DVLPMT				
Berkeley Lab-Site, DOE-owned Blds	38	64.47	278.38	713,797
Berkeley Lab-Site, DOE-owned Expt'l Facil	3	0.05	1.70	4,362
Berkeley Lab-Site, DOE-owned Trlrs	6	0.25	1.93	8,045
Berkeley Lab-Site, UC-owned	1	0.00	2.53	6,483
Berkeley Lab-Site, Leased	1	0.00	11.98	30,720
Off-Site, UC-owned	23	0.00	80.83	207,264
Subtotals	72	64.77	377.35	970,671
16 REACTOR & ACCEL				
Berkeley Lab-Site, DOE-owned Blds	5	13.43	167.65	387,892
Berkeley Lab-Site, UC-owned	1	0.00	8.94	20,800
Subtotals	6	13.43	176.60	410,692
SUBTOTAL A: BUILDING SPACE	**157**	**98.77**	**734.89**	**1,988,449**
PROPRIETARY INTEREST				
DOE-owned	126	98.77	594.61	1,588,131
Leased	5	0.00	45.85	159,711
UC-owned	26	0.00	94.43	240,607
Subtotal A: Building Space	**157**	**98.77**	**734.89**	**1,988,449**

*Acquisition and Improvements.

Table 3-7. Life Cycle Plans Summary.

Functional Unit	# Assets	Original* Cost ($M)	RPV ($M)	Total GSF
B. SITE IMPROVEMENTS, UTILITIES, COMMUNICATIONS				
30 TRANSPORTATION SYSTEMS				
Roads, Walks & Paved Areas			4.64	
			4.64	
31 OTHER KNOWN ASSETS				
Miscellaneous Site Improvements			4.36	
Roads, Walks & Paved Areas			0.21	
Fences & Guard Towers			0.20	
Gas Prod, Transm & Distrib Sys			0.07	
Improvements to Prop of Others			0.40	
			5.25	
33 STORAGE				
Other Structures			0.07	
Gas Prod, Transm & Distrib Sys			0.26	
Wtr Supply, Pumpg, Treatmt & Distrib Sys			0.73	
			1.07	
34 INDUSTRIAL/PRODUCTION/ PROCESS				
Elec Gen, Transm & Distrib Sys			0.14	
Gas Prod, Transm & Distrib Sys			0.00	
Sewerage Sys			0.06	
Wtr Supply, Pumpg, Treatmt & Distrib Sys			5.81	
			6.01	
35 SERVICES STRUCTURES				
Other Structures			0.42	
			0.42	
36 COMMUNICATIONS AND SECRUITY				
Other Structures			0.01	
Communication Systems			6.77	
Fire Alarm Sys			1.03	
Sewerage Sys			0.15	
			7.96	
37 DISTRIBUTION SYSTEMS				

*Acquisition and Improvements.

Table 3-7. Life Cycle Plans Summary.

Functional Unit	# Assets	Original* Cost ($M)	RPV ($M)	Total GSF
Other Structures			0.03	
Elec Gen, Transm & Distrib Sys			5.57	
Gas Prod, Transm & Distrib Sys			2.90	
Sewerage Sys			2.51	
Wtr Supply, Pumpg, Treatmt & Distrib Sys			2.21	
			13.22	
B. Site Improvements, Utilities, Communications Subtotal			**38.57**	
C. ACCELERATORS				
38 ACCELERATORS				
Reactors & Accelerators			52.71	
Improvements to Prop of Others			70.00	
			122.71	
C. Accelerators Subtotal			122.71	
GRAND TOTAL BERKELEY LAB OTHER STRUCTURES AND FACILITIES			161.28	
D. EQUIPMENT				
51 Hospital & Medical Equipment		72	0.68	
52 Laboratory Equipment		5,961	133.25	
53 Motor Vehicles		203	4.31	
54 Office Furniture & Equipment		369	1.20	
58 Security & Protection Equipment		45	0.44	
59 Shop Equipment		344	7.63	
60 Automatic Data Processing Equipment & Software		7,867	40.28	
79 Miscellaneous Equipment		287	8.33	
D. Equipment Subtotal		**15,148**	**196.12**	

*Acquisition and Improvements.

Building Space (Class A)

This class encompasses functional units which provide building space including permanent buildings, trailers and trailer complexes owned by DOE, buildings leased for Berkeley Lab use, and buildings and portions of buildings owned by the University of California which are used for DOE programs under the basic UC-DOE operating contract. DOE-owned facilities are located on property owned by the University.

Site Improvements, Utilities and Communications (Class B)

These are capital assets paid for by DOE and located on University property that support DOE programs.

Accelerators and Other Equipment (Class C)

Although the accelerators are major scientific instruments, they are classified with all other types of equipment. Buildings housing accelerators are included in Functional Unit 16, Accelerator Buildings, which belongs to Category A.

Planning Assumptions

Berkeley Lab has actively pursued the rehabilitation and modernization of its buildings, utilities and site improvements for many years. These efforts have resulted in the seismic rehabilitation of 34 buildings and the seismic stabilization of roadways, site

improvements and critical lifelines. In recent years, this work, now over 90% complete or funded, has been augmented with a series of line item, general plant and noncapital alteration projects to rehabilitate and upgrade electrical and mechanical site utilities and modernize buildings to correct ES&H deficiencies. These initiatives include measures to provide advanced safeguards for scientific work with hazardous materials, new hazardous waste handling facilities, and environmental monitoring facilities. Berkeley Lab has also significantly improved its scheduled maintenance system, developed a site-wide Plant Inspection System Upgrade Program, and implemented an aggressive capital equipment replacement program. It is anticipated that these rehabilitation and replacement programs, which must be spread over a number of years, will continue to be a major area of effort over the planning period covered by this CFP.

During the last decade Berkeley Lab has successfully evolved from a laboratory predominately concerned with accelerators and high energy physics to a strong multiprogram laboratory. The development of new national program directions for Nuclear Physics resulted in the shutdown of the Bevalac Nuclear Physics Program during FY 1993. The Bevalac, which is a combination of two major accelerators, the SuperHILAC and the Bevatron, will undergo decommissioning and decontamination over the next several years. Over the same period of time, the Advanced Light Source, a major, $100 million scientific instrument and national user facility, came on line in FY93 and will develop additional experimental facilities for as many as 250 visiting researchers at any one time. These activities will eventually require more support than did the Bevalac.

Berkeley Lab has a special ability to respond quickly and effectively to new national priorities in basic research and applied sciences. This ability is attributable not only to its multiprogram base, but also to its proximity and interactive relationship with the University of California at Berkeley. The Berkeley Lab site, however, is constrained by its hillside terrain and urban location. Consequently, major planning objectives for future development of the Berkeley Lab site are to rehabilitate and upgrade existing facilities if it is cost effective to do so and to replace old, obsolete and maintenance intensive facilities that can't be upgraded economically. Future development at Berkeley Lab is based on redevelopment of the older, original Laboratory site constructed in the 1940s and the rehabilitation and upgrading of facilities constructed during the 1960s and 70s. In keeping with this plan, the availability of heavy laboratory buildings and related support systems which have housed the Bevalac accelerators will provide exceptional opportunities for very cost effective programmatic initiatives in the national interest.

These objectives parallel congressional priorities incorporated in Section 2203(d) of the

Energy Policy Act (EPACT) of 1992 for "Facilities Support of Multiprogram Energy Laboratories," and, Berkeley Lab has defined 5 project categories, corresponding to congressional priorities, to which projects listed in the Life Cycle Chart for each Functional Unit can be related. These "Legislative Need Categories" (or "Goals") are as follows:

- Category 1. Correction of deficiencies in structural, mechanical, electrical and other support and infrastructure systems to ensure safety and health of employees, visitors and the general public in compliance with environmental regulations
- Category 2. Repair and rehabilitation of support facilities, including equipment and infrastructure, to assure continued cost effective use, prevent deterioration, and protect the national investment
- Category 3. Modification or addition to existing support facilities to ensure their capacity and technological capability to meet the needs of new or expanded programs
- Category 4. Modification or addition to existing support facilities to incorporate and consolidate operations that are uneconomically separated, dispersed or housed in obsolete, deteriorated or temporary buildings
- Category 5. Replacement and removal of old, deteriorated, and outmoded support facilities that can no longer be economically upgraded, maintained and operated.

Assigning Projects to Functional Unit Categories

Building projects that significantly mitigate or resolve deficiencies in more than one functional unit are shown in the life cycle chart for the primary functional unit in which the majority of the work (in dollar value) will be accomplished.

Current Plant Value

Current Plant Values (CPVs) have been calculated by individually escalating and summing acquisition and improvement costs using Engineering News Records annual average Building Cost Indices from the year the acquisition or improvement was capitalized to the current fiscal year. The correlation between CPVs calculated this way and the current Replacement Plant Value is generally poor.

Replacement Plant Value

Replacement Plant Values (RPVs) have been estimated for functional units in the Building Space class (Class A). They are based upon unit costs in dollars per gross square foot from recent experience with projects on the Berkeley Lab Site. Project costs that should be covered in functional units for equipment rather than buildings are not included in the RPVs for buildings. The estimated unit RPVs include the following costs:

- Engineering, design, and inspection (ED&I) with appropriate weighting for the degree of A-E design, in-house engineering, construction, inspection, consultation (including geotechnical investigation), testing laboratories, energy analyses, value engineering, estimate reviews, hazardous materials analysis, safety analysis reports, third party seismic reviews, project and construction management, and quality assurance requirements.
- Building construction costs, including special facilities required to provide an operating facility for the use intended.
- Site utilities and site improvements necessary to connect into the site infrastructure.
- Contingencies with appropriate weighting for complexity and risk.
- Estimated unit costs do not include:
- Standard equipment and off-the-shelf movable equipment.
- Equipment that can be substituted for space, such as automated storage equipment.
- Incremental additions to site utilities to increase the capacity of supplies.

Unit square foot costs are for buildings of about 4500 sm (50,000 sf). Unit costs for smaller buildings will increase significantly with increase in perimeter-area ratio. The unit cost decreases for larger buildings are less significant.

As priced, trailers include foundations, tiedowns, and sprinklers, but not ramps, decks, toilets or unit substations.

Modular buildings designed to Building Codes are estimated to cost the same as conventional buildings.

The RPVs listed in this report are based on the unit costs in Table 3-8.

Table 3-8. Unit Cost Basis for RPVs.

FU No.	Descriptor	$/GSF
10	Administrative Buildings	310
12	Storage Buildings	259
14	Service Buildings	362
15	R&D Buildings	403
16	Accelerator Buildings	445
	Trailers	248

Functional Unit 10 — Administrative Buildings

Basis. This functional unit is made up of the following facilities:

- Buildings
- Trailers
- Offsite Leased Space

Although trailers have been classified as vehicular equipment in the FIS accounting structure, trailers that provide administrative office space for Berkeley Lab are included in this functional unit for purposes of life cycle planning.

Table 3-9 lists buildings, trailers and leased facilities that provide predominantly administrative or scientific support space for Berkeley Lab's mission.

The purpose of this functional unit is to provide offices for administrative, engineering, safety and scientific use to support Laboratory missions. As shown in Table 3-9, a significant amount of this space is rated as "Condition 3" (or "Rehab Status 3"). This category comprises substandard buildings and temporary trailers that have aged beyond their useful life and it is not economically feasible to bring them up to current standards of environmental health and safety or functional adequacy. Much of the rest are categorized as "Condition 2" because they are approaching technological and functional obsolescence but can be economically upgraded to safe, efficient support space.

Trends and Background. During the 1970's, when wet chemistry activities were on the decline and new energy and environment research developed with paper studies, the pressing need for additional office space was met by converting wet laboratory space to office use and by crowding offices into operational laboratory space. In addition, the need was partially accommodated by adding temporary trailers on-site and relocating administrative support functions in leased, remote space off-site. Since funding for new on-site office space was not forthcoming, these conditions exist today.

In recent years the added emphasis on health, safety and environmental issues and the proliferation of related regulations has required a significant increase in EH&S and Plant Engineering staff. Consequently, additional administrative departments have been moved off-site into leased space and more such moves must be planned to accommodate the urgent need for additional office space on-site.

In the interim existing substandard office space and aged trailers have become increasingly overcrowded and maintenance intense. Expedient measures used to alleviate the immediate demands for office space on-site can only buy time for more realistic and permanent measures to be funded and implemented. These take the form of projects to

Table 3-9. Assets List, Buildings, Functional Unit 10 (Administrative Buildings).

Prop ID	Prop Name	Area (GSF)	Cost ($K) Orig	Imprv	Total	CPV[1]	RPV[2] ($K)	Age	Useful Life[3] DSG Life	Curr	w/Defic Corrc	Cond[4]
DOE-Owned Buildings (Berkeley Lab Site)												
29	Electrnc Instrmtn, Ls	10298	55	46	101	700	3192	47	25	10	NA	3
50A	Adm, Dir, Opa, Patnts, Counsel	66714	1869	878	2747	11916	20681	32	50	20	40	2
50C	Pub Info, Media Relns, Currnts	2766	374	0	374	607	857	14	10	10	20	2
50D	Nuclear Science	4959	564	0	564	976	1537	15	25	10	20	2
50E	Earth Sciences	10923	887	0	887	1156	3386	10	50	30	40	2
50F	TID, Computing Services	8300	904	–70	834	1085	2573	9	50	31	40	2
54	Cafeteria	11806	105	495	600	2772	3660	44	50	15	30	2
65	Data Processing Services	3441	28	276	305	1095	1067	42	25	10	15	3
69	Bus Svc, Mtl Mgmt, Purch, Mail	17654	139	893	1031	1962	5473	27	50	23	40	2
80A	Electronics Instln & Fab	960	23	0	23	47	298	17	10	10	20	2
90	Eng,EE,EH&S,Prsnl,Emply,Cashr	88301	1289	1081	2370	9840	27373	34	50	16	50	2
B-51B	Biomedical Facilities	2780	3	0	3	16	862	33	10	5	NA	3
Subtotals DOE-Owned Blds (Berkeley Lab Site)		228,902	6,240	3,599	9,839	32,171	70,960					
DOE-Owned Trailers (Berkeley Lab Site)												
76L	Facilities Dept	1440	19	0	19	39	357	17	10	5	NA	3
B-7B	Inventory Management	473	15	0	15	30	117	17	10	5	NA	3
B-7C	Materiel Management	473	15	0	15	30	117	17	10	5	NA	3
B-29A	Elecncs Eng'g, Computer Sci	1673	53	0	53	100	415	16	10	5	NA	3
B-29B	Electronics Drafting	1420	38	0	38	72	352	16	10	5	NA	3
B-29C	Energy & Environment	1282	38	0	38	72	318	16	10	5	NA	3
B-31A	Earth Science	624	11	0	11	0	155	?	10	5	NA	3
B-44A	Facilities Dept Inspectors	480	16	0	16	30	119	16	10	5	NA	3
B-44B	Energy & Environment	1439	47	0	47	81	357	15	10	5	NA	3
B-46B	Energy & Environment	1238	39	0	39	68	307	15	10	5	NA	3
B-46C	Mechanical Engineering	1028	26	0	26	52	255	17	10	5	NA	3
B-46D	Accel & Fusion Rsch, Mech Eng	775	43	0	43	57	192	10	10	5	NA	3
B-51L	Vax User Facility	863	149	0	149	193	214	9	10	5	10	1
B-52B	Materiel Management	1174	36	0	36	73	291	17	10	5	NA	3
B-53B	AFR, Elecncs Eng'g	464	13	0	13	38	115	22	10	5	NA	3
B-55A	Life Sciences	520	15	0	15	28	129	16	10	5	NA	3
B-62A	Engy & Env, Matl Sci	1248	33	0	33	62	310	16	10	5	NA	3
B-64A	Bevatron Riggers	515	10	0	10	45	128	26	10	NA	NA	3
B-65A	Data Processing	1425	27	0	27	35	353	10	10	5	NA	3
B-65B	Data Processing	1020	59	0	59	77	253	11	10	5	NA	3
B-67B	Energy & Environment	1237	33	0	33	62	307	16	10	5	NA	3

Table 3-9. Assets List, Buildings, Functional Unit 10 (Administrative Buildings).

Prop ID	Prop Name	Area (GSF)	Cost ($K) Orig	Imprv	Total	CPV[1]	RPV[2] ($K)	Age	Useful Life[3] DSG Life	Curr	w/Defic Corrc	Cond[4]
B-71B	AFR Exploratory Studies	512	10	0	10	49	127	28	10	NA	NA	3
B-71C	AFR Exploratory Studies	511	10	0	10	49	127	28	10	NA	NA	3
B-71D	Chemical Sciences	520	11	0	11	40	129	24	10	NA	NA	3
B-71E	Accel & Fusion Rsch, Chem Sci	513	12	0	12	46	127	24	10	NA	NA	3
B-71F	Energy & Environment	516	13	0	13	33	128	20	10	NA	NA	3
B-71G	Office Trailer	517	13	0	13	35	128	20	10	NA	NA	3
B-71H	Electronics Engineering	1424	45	0	45	151	353	23	10	NA	NA	3
B-71J	Accel & Fusion Rsch	1288	40	0	40	69	319	15	10	5	NA	3
B-71K	Electronics Eng'g, Cmptr Sci	474	17	0	17	32	118	16	10	5	NA	3
B-72D	Center For Advanced Materials	683	9	0	9	0	169	?	10	5	NA	3
B-77G	Mechanical Processes	710	15	0	15	33	176	18	10	5	NA	3
B-90B	Facilities Dept	1440	11	0	11	22	357	17	10	5	NA	3
B-90C	Facilities Dept	1185	33	0	33	68	294	17	10	5	NA	3
B-90E	Contractor's Office	188	6	0	6	13	47	17	10	5	NA	3
B-90F	Facilities Dept	2461	76	0	76	132	610	15	10	5	10	3
B-90G	Facilities Dept	1846	57	0	57	108	458	16	10	5	10	3
B-90H	Facilities Dept	1849	57	0	57	108	459	16	10	5	10	3
B-90J	Facilities Dept	2846	88	0	88	166	706	16	10	5	10	3
B-90K	Facilities Dept	2845	88	0	88	166	706	16	10	5	10	3
B-90P	Library	2130	66	0	66	114	528	15	10	5	10	3
Subtotal DOE-Owned Trailers (Berkeley Lab Site)		45269	1412	0	1412	2677	11227					
Subtotal, DOE-Owned		274171	7652	3599	11251	34848	82186					
Leased Buildings (Off-Site)												
936	Berkeley Center (Hink's):Afm	16196	0	0	0	0	5021	NA	NA	NA	NA	NA
938	The Promenade	19569	0	0	0	0	6066	NA	NA	NA	NA	NA
Subtotals, Leased (Off-Site)		35765	0	0	0	0	11087					
Subtotals, Leased		35765	0	0	0	0	11087					
Totals, Administrative		**309936**	**7652**	**3599**	**11251**	**34848**	**93273**					

[1]CPV calculated by individually escalating and summing acquisition and improvement costs using *Engineering News Record's* annual average Building Cost Index to determine escalation factor.
[2]RPV calculated at: 310$/SF (Administrative), 259$/SF (Storage), 362$/SF (Production), 362$/SF (Service), 403$/SF (R&D), 445$/SF (Accel), 248$/SF (Trailers) using August 1993 escalation rate of 3.4% for 1994.
[3]Useful life based on best engineering estimate.
[4]**Rehab Status 1** = Adequate **Rehab Status 2** = Approaching technological and functional obsolescence but can be economically upgraded to adequate space. **Rehab Status 3** = Substandard buildings and temporary trailers that have aged beyond their useful life. Not economically feasible to upgrade to current environmental health and safety standards or functional adequacy.

rehabilitate existing facilities now categorized under Condition 2, new office space to replace trailers and substandard buildings categorized as Rehab Status 3, new office space to eliminate the inefficient use of remote and expensive off-site office leases and new low-cost office space strategically located on-site to eliminate the crowding and less safe use of existing and costly laboratory space for offices.

In 1993, the Bevalac was shut down. However, the impact of the loss of these operations on the need for office space has been more than offset by the operational development of the ALS, which came on line in FY 1993. The ALS, a national users' facility, was funded for an initial complement of offices and support facilities for visiting users; however, the need for close-in satellite office space will increase dramatically over the next several years, when as many as 250 visitors may be conducting research at any one time. Although capital programmatic funding will be sought to provide ALS support offices, it is anticipated that the user pressure will outpace the availability of new construction, bringing additional pressure on the infrastructure supporting Berkeley Lab operations, visitor center services, cafeteria, procurement staff, EH&S support, maintenance and related administrative functions, as well as increasing the need for trailers and offsite leased space.

On-site permanent buildings in Functional Unit 10, total about 21,000 gsm (225,000 gsf). Over 80% (17,000 gsm or 183,000 gsf) of this space is between 30 and 45 years old and less than 20% (4,000 gsm or 42,000 gsf) is under 25 years old. Temporary trailers and modular buildings comprise the remaining on-site space (7,500 gsm or 80,000 gsf) in this functional unit. Almost all the trailers are well beyond their anticipated useful life. Aged buildings and trailers, which comprise over 86% of Berkeley Lab's inventory of administrative office space, are maintenance intensive.

Life Cycle Chart. For the purposes of this report Berkeley Lab has established five (5) Legislative need categories, described in the Function Unit 10 Life Cycle Chart (Administrative Buildings), Table 3-10, which are tied into the 3 Congressional priorities incorporated in Section 2203(d) of the Energy Policy Act (EPACT) of 1992.

Functional Unit 12 — Storage Buildings

This functional unit is made up of the following facilities:

- Buildings
- Trailers
- Off-site Leased Space

Table 3-11 lists buildings, trailers and leased facilities that make up Berkeley Lab's storage facilities.

The purpose of this functional unit is to provide space for storage and related activities to support Berkeley Lab's missions. Currently, Berkeley Lab's main warehouse and receiving operations are located in two leased facilities about two miles off-site. A central stores facility and satellite storage buildings to directly serve shops operations are located strategically on-site. Facilities for the temporary storage and packaging of hazardous waste are also provided on-site.

Generally, all on-site storage space is aged, substandard and cannot be made adequate with the exception of those facilities designed as special purpose stores buildings for close-support shops operations. Berkeley Lab's main central stores facility, Building 7, is an aged wood frame structure of substandard design and construction which was built during World War II. It is designated for demolition to eliminate its fire hazard to the adjacent Advanced Light Source. A replacement facility for the Central Stores operation to be located near Berkeley Lab's Grizzly Gate is planned for FY 1996.

Berkeley Lab's existing hazardous waste handling facility, which is now housed on-site in a temporary building in a populated area of the Laboratory, is also scheduled for demolition once construction of a new facility located in a remote area of the site is completed in FY 1996.

The Laboratory anticipates continuing long term demand for storage facilities and related support facilities. These demands stem from existing inadequate storage in temporary and mobile storage units and the use of service and administrative space for storage functions. However, some reductions in storage

Table 3-10. Functional Unit 10 Life Cycle Chart (Administrative Buildings).

Event Problem/Need	Deficiencies	Existing Requirements	Project Title	Legislative Need*	Funding Type/Status	TEC $M FY
EH&S staff in trailers, Electronics Engineering and Stores Facility in aged building to be removed. Dispersed operations	Lack of permanent space; insufficient space; existing space noncompliant with codes and regulations	32,200 GSF of office, light lab, materials handling, and storage space	Safety and Support Services Facility	1, 3, 4, 5	Line Item proposed MEL-FS/KG-02	12.8 FY96
Lack of adequate environmental monitoring and industrial hygiene technological capability and capacity	Insufficient space; lack of laboratories; dispersed and inefficient operations; lack of modern equipment	32,000 GSF of office, light lab, training facilities and related equipment	Environmental Monitoring and Industrial Hygiene Building	1, 3, 4, 5	Line Item proposed MEL-FS/KG-02	24.9 FY97
Lack of adequate engineering, plant records, and emergency operations space	Facilities Department in aged and dispersed trailers; lack of safe records space; EOC operations susceptible to seismic damage; inefficient operational conditions	28,600 GSF of engineering office space and related equipment	Facilities Building	1, 3, 4, 5	Line Item proposed MEL-FS/KG-01	16.5 FY97
Substandard HVAC. Inadequate access for handicapped persons, over crowded office, asbestos ceiling and exterior building tiles. Aged roof	Patients and employees lack adequate HVAC. Lack of egress and refuge areas for handicapped persons. Lack of office space. Asbestos hazard	Replace HVAC system, remove asbestos hazard and barriers to handicapped persons, add 1400 SF of office space and partially replace roof	Medical Services Asbestos Abatement and Rehab	1,2,3,4	Line Item proposed MEL-FS/KG-02	3.2 FY98
Lack of space for administrative and technical services support functions	Admin. offices crowded and dispersed into existing lab space, trailers including data communications, computing support, info services and management functions	18,400 GSF of office space in close proximity to Director's Office	Admin. Services Addition - Bldgs. 50E and F, 2nd Floor	2, 4, 5	Line Item proposed MEL-FS/KG-01	9.4 FY99
Lack of efficient consolidated space for technology transfer activities	Insufficient and dispersed space for related operations	Integrated office, conference and communication center for sponsored research, technology transfer	Technology Transfer Bldg.	3, 4	Line Item?proposed?MEL-FS/KG-01	11.9 FY00

Table 3-10. Functional Unit 10 Life Cycle Chart (Administrative Buildings).

Event Problem/Need	Deficiencies	Existing Requirements	Project Title	Legislative Need*	Funding Type/Status	TEC $M FY
New for auditorium seating space; egress, seismic and technological upgrading	Lack of seating space, technological obsolescence, life safety risks	Expanded auditorium seating, improved egress, seismic strengthening and technological upgrading	Bldg. 50 Auditorium Expansion	1,2,3,4	Line Item?proposed?MEL-FS/KG-01	8.8 FY02
Need for day care facility	No existing facilities for day care support	10,000 GSF of child care facilities and related outdoor area	Day Care Facility	4	Line Item?proposed?MEL-FS/KG-01	5.8 FY03
Lack of office space for Science & Engineering Education Center, Public Info, Employment, Badge Office, Visitors Services and Tech Info	Insufficient space in temporary and dispersed facilities on-site and leased facilities off-site	15,000 GSF of office, training and conference space	Science, Education and Visitor Center	3,4	Line Item?proposed?MEL-FS/KG-01	11.1 FY05
Offices crowded into hi-bay storage space and temporary trailers, inefficient operations	Overcrowding, dispersed operations, seismic deficiencies	Add 7,000 GSF to Building 78 Craft Shops Building and correct seismic deficiencies	Maintenance Building Replacement, Phase II Building 78 Addition	1,2,3,4	Line Item?proposed?MEL-FS/KG-01	5.4 FY03

*Project Categories.

1. Correction of deficiencies in structural, mechanical, electrical and other support and infrastructure systems to ensure safety and health of employees, visitors and the general public in compliance with environmental regulations.
2. Repair and rehabilitation of support facilities, including equipment and infrastructure to assure continued cost effective use, prevent deterioration and protect the national investment.
3. Modification or addition to existing support facilities to ensure their capacity and technological capability to meet the needs of new or expanded programs.
4. Modification or addition to existing support facilities to incorporate and consolidate operations that are uneconomically separated, dispersed or housed in obsolete, deteriorated or temporary buildings.
5. Replacement and removal of old, deteriorated and outmoded support facilities which can no longer be economically upgraded, maintained, and operated.

Table 3-11. Assets List, Buildings, Functional Unit 12 (Storage Buildings).

Prop. ID	Prop. Name	Area (gsf)	Cost ($K) Orig	Imprv	Total	CPV[1]	RPV[2] ($K)	Age	DSG Life	Useful Life[3] Curr	w/Defic Corrc	Cond[4]
DOE-Owned Buildings (Berkeley Lab-Site)												
7	Cen Stors,Elcnc Shps,Inv Mgmt	21760	107	354	460	2046	5636	51	25	5	NA	3
75A	Compactor, Processing, Storage	4064	106	0	106	131	1053	7	10	3	10	3
78	Craft Stores	5392	115	3	117	567	1397	28	50	12	40	2
79	Metal Stores	4453	94	0	94	470	1153	29	50	11	40	2
B-88B	Compressor Shelter, Storage	534	0	0	0	0	138	?	50	50	50	2
	Subtotals, DOE Owned Blds (Berkeley Lab Site)	36203	421	356	777	3213	9377					
DOE-Owned Trailers (Berkeley Lab Site)												
B-75D	Waste Storage	1035	4	0	4	7	257	16	10	5	NA	3
B-76K	Construction & Maintenance	370	0	0	0	0	92	?	10	5	NA	3
	Subtotals, DOE-Owned Trls (Berkeley Lab Site)	1405	4	0	4	7	348					
	Subtotals, DOE-Owned	37608	424	356	781	3221	9725					
Leased (Off-Site)												
901	Warehouse, Receiving	69680	0	0	0	0	18047	NA	NA	NA	NA	NA
901A	Used Furniture, Excess Matl	26802	0	0	0	0	6942	NA	NA	NA	NA	NA
	Subtotals, Leased (Off-Site)	96482	0	0	0	0	24989					
	Subtotals, Leased	96482	0	0	0	0	24989					
	Totals, Storage	**134090**	**424**	**356**	**781**	**3221**	**34714**					

[1]CPV calculated by individually escalating and summing acquisition and improvement costs using *Engineering News Record's* annual average Building Cost Index to determine escalation factor.
[2]RPV calculated at: 310$/SF (Administrative), 259$/SF (Storage), 362$/SF (Production), 362$/SF (Service), 403$/SF (R&D), 445$/SF (Accel), 248$/SF (Trailers) using August 1993 escalation rate of 3.4% for 1994.
[3]Useful life based on best engineering estimate.
[4]**Rehab Status 1** = Adequate **Rehab Status 2** = Approaching technological and functional obsolescence but can be economically upgraded to adequate space. **Rehab Status 3** = Substandard buildings and temporary trailers that have aged beyond their useful life. Not economically feasible to upgrade to current environmental health and safety standards or functional adequacy.

are possible through the Berkeley Lab waste minimization program, which seeks to minimize on-site inventories of chemical and other potential wastes, and through increased use of electronic communications and media. The Laboratory, however, must comply with appropriate DOE requirements regarding the storage and maintenance of all types of materials and records. Furthermore, federal administrative and DOE directives that add mandated requirements and paperwork call for increased formality and security of stored materials. Under these conditions the increased need for specialized storage facilities is likely to continue.

Storage facilities, access and transportation of materials must comply with DOE orders such as Materials Transportation and Traffic Management (DOE 1540.1); Capital Assets Management Program (DOE 4320.2); Records Management Program (DOE 1324.2A); and Physical Protection of DOE Property and Unclassified Facilities (DOE 5632.6). All storage facilities must be in compliance with the occupancy requirements of the Uniform Building Code, the Uniform Fire Code, and DOE regulations including EH&S requirements, such as Fire Protection (DOE 5480.7). Berkeley Lab's Facilities Department and Property Management staff anticipate that improvement in Berkeley Lab's existing storage facilities is required, including craft stores and metal stores. Berkeley Lab's new Hazardous Waste Handling Facility will mitigate existing storage demands in the Building 75 vicinity, and the Safety and Support Services Facility will replace substandard central storage facilities. Improvements in on-site storage will reduce demands for leasing offsite storage space. In addition the Berkeley Lab Site Plan calls for the consolidation of multiple small storage facilities into single storage facilities and multistore storage facilities, as appropriate. Deficiencies and requirements for this functional unit are included in projects that are listed in life cycle charts for other functional units in which the majority of the work in dollar value will be accomplished.

Functional Unit 14 — Service Buildings

This functional unit is predominantly composed of various shop facilities that support Berkeley Lab's R&D programs. A few miscellaneous buildings and trailers which support these activities are also included, as well as the Berkeley Lab Fire Station buildings. These assets are listed in Table 3-12. Table 3-12 includes permanent buildings and temporary trailers, which are located on-site, and the Chicken Creek Maintenance Facility, an off-site building and yard facility contiguous to the Berkeley Lab site on leased UC Berkeley land.

The condition of these facilities varies from adequate to substandard that cannot be made adequate. Building 25, the Mechanical Technology Building, is a major facility that is technologically obsolescent and does not meet current codes, standards and regulations. This facility continues to support the missions of the Laboratory through the efforts of skilled staff, although the operational environment is very inefficient. The removal of Building 25 and the relocation of these support operations are key steps in Berkeley Lab's long-range plan for redevelopment of the oldest portion of the Laboratory in the vicinity of the Advanced Light Source. Three other important facilities, Building 76 (the Construction and Maintenance Crafts Building), Building 77 (the Mechanical Shops Building), and Building 25A (the Electronics Shops Building) are substandard, but can be made adequate. The rehabilitation of these facilities are critical to the missions of the Laboratory.

Berkeley Lab planning assumptions indicate that the demand for improvements to service facilities will continue to increase. Service facilities include fully operational electrical and mechanical shops. Support functions such as metal stores, wastewater processing, solvents and chemical stores and painting operations are located nearby. Critical to planning assumptions are upgrades and replacements to service programs that require clean areas for operations, such as assembly of vacuum systems and detector fabrication. Improved compliance with environmental regulations, and building and fire protection codes is also required. The Laboratory has the

Table 3-12. Assets List, Buildings, Functional Unit 14 (Service Buildings).

Prop. ID	Prop. Name	Area (gsf)	Cost ($K) Orig	Imprv	Total	CPV[1] ($K)	RPV[2] ($K)	Age	Useful Life[3] DSG Life	Curr	w/Defic Corrc	Cond[4]
DOE-Owned Buildings (Berkeley Lab Site)												
25	Mechanical Technology Shops	20391	74	389	462	2690	7382	47	50	5	NA	3
25A	Electronics Shops	7335	119	29	149	774	2655	31	50	19	40	2
26	Health Services	10413	119	1117	1235	1484	3770	30	50	20	40	2
36	Grizzly Substation Switchgear	901	1383	0	1383	1583	326	3	50	47	NA	1
42	Salvage	1215	10	0	10	142	440	52	20	5	15	3
45	Fire Apparatus	3278	188	0	188	709	1187	24	50	26	NA	1
48	Fire Station, Emg Svcs	4221	436	7	443	664	1528	13	50	37	NA	1
56	Cryogenic Facility	961	480	3	483	907	348	16	25	NA	NA	3
76	Cnst & Maint / Crafts Shops	31450	747	195	942	4300	11385	30	50	20	40	2
77	Mechanical Processes	68768	2184	581	2766	12645	24894	31	50	19	40	2
77A	Ultra High Vacuum Cleaning Fac	10862	1754	0	1754	2125	3932	6	50	44	NA	1
81	Liquid Gas Storage	1129	44	0	44	190	409	26	20	10	20	2
	Subtotals, DOE-Owned Blds (Berkeley Lab Site)	160924	7538	2321	9859	28213	58254					
	Subtotals, DOE-Owned	160924	7538	2321	9859	28213	58254					
UC-Owned (Berkeley Lab Site)												
31	Chick Crk Maint,Geophys Msrmts	6060	0	0	0	0	2194	NA	NA	NA	NA	NA
	Subtotals, UC-Owned (Berkeley Lab Site)	6060	0	0	0	0	2194					
	Subtotals, UC-Owned	6060	0	0	0	0	2194					
	Totals, Service	**166984**	**7538**	**2321**	**9859**	**28213**	**60448**					

[1]CPV calculated by individually escalating and summing acquisition and improvement costs using *Engineering News Record's* annual average Building Cost Index to determine escalation factor.
[2]RPV calculated at: 310$/SF (Administrative), 259$/SF (Storage), 362$/SF (Production), 362$/SF (Service), 403$/SF (R&D), 445$/SF (Accel), 248$/SF (Trailers) using August 1993 escalation rate of 3.4% for 1994.
[3]Useful life based on best engineering estimate.
[4]**Rehab Status 1** = Adequate **Rehab Status 2** = Approaching technological and functional obsolescence but can be economically upgraded to adequate space. **Rehab Status 3** = Substandard buildings and temporary trailers that have aged beyond their useful life. Not economically feasible to upgrade to current environmental health and safety standards or functional adequacy.

goal of full compliance with current and proposed building codes anmd DOE regulations, including revisions that are part of the 1994 Uniform Building Code and that will necessitate upgrades to current building plans and standards.

In 1991 the DOE Tiger team found deficiencies in shop and service facilities, including insufficient distances between equipment, substandard access, electrical and fire code problems, and the need to comply more effectively with DOE orders such as the Capital Assets Management Program. All service facilities must be in compliance with the Uniform Building Code, the Uniform Fire Code and applicable DOE regulations, including EH&S requirements such as Fire Protection (DOE 5480.7). Berkeley Lab's Engineering Division and Facilities Department anticipate that improvement in Berkeley Lab's existing service facilities is required, including electrical and mechanical shops, plant maintenance shops and others. The proposed Facilities Building will mitigate overcrowding in the crafts shops building, improve operational safety and efficiency, and improve emergency response. In addition, the Berkeley Lab Site Plan calls for the consolidation of multiple small shop facilities into more consolidated shop facilities, as appropriate. Deficiencies and requirements for this functional unit are summarized in the Functional Unit 14 Life Cycle Chart, Table 3-13.

Functional Unit 15 — Research and Development Buildings

Buildings in this functional unit are categorized as follows:

- Buildings on-site used predominantly for R&D activities.
- Experimental facilities, temporary structures and buildings erected for the life of an experimental R&D project.
- Trailers used for R&D activities.
- U.C. Berkeley building space used for Berkeley Lab/DOE programs.
- Off-site leased space used predominantly for R&D activities.

Although trailers have been classified as vehicular equipment in the FIS accounting structure, those trailers that provide R&D space for Berkeley Lab programs are included in this functional unit for purposes of life cycle planning.

Table 3-14 lists buildings, experimental facilities, trailers, U.C. Berkeley building space and off-site leased space that provide space for Berkeley Lab's R&D missions.

The condition of Berkeley Lab's inventory of R&D facilities varies from excellent (new laboratories such as the Advanced Materials Laboratory and the new Advanced Light Source, which came on line in FY 1993) to substandard facilities that cannot be made adequate (old facilities built during World War II without the benefit of adequate materials or building code control). The bulk of Berkeley Lab's older laboratory space is, however, classified as substandard that can be made adequate. These facilities are structurally sound but lack the modern electrical and mechanical systems and operational and environmental safeguards to fulfill new building codes and safety and environmental regulations that have proliferated during the last decade.

Also, during the 1970's, when wet chemistry activities were on the decline and new energy and environment research developed with paper studies, the pressing need for additional office space was met by converting wet laboratory space. Since then, however, these paper studies have led to laboratory research and experimental programs resulting in an urgent and present need for more laboratory space. Current planning strategy includes proposals for the addition of new general purpose office space in close proximity to those laboratories now used for research offices. In this way existing laboratory space, which is very expensive to build, can be regained by relocating office occupants to new low-cost office space. In effect Berkeley Lab would "buy" laboratory space for the price of office space. This new office space would add to Berkeley Lab's functional unit of Administrative Office Space.

Table 3-13. Functional Unit 14 Life Cycle Chart (Service Buildings).

Event Problem/Need	Deficiencies	Existing Requirements	Project Title	Legislative Need*	Funding Type/Status	TEC $M FY
Need for Craft Shops Building 76 for recovery in the aftermath of earthquake, ineffective HVAC system	Building 76 will suffer damage and shutdown in a major earthquake. Aged, under capacity HVAC systems.	Improve seismic strength and mechanical systems to function in aftermath of earthquake.	Maintenance Building Replacement, Phase I Building 76	1,2,3	Line Item proposed (MEL-FS/KG-01)	6.5?FY00
Roof failures, damaged contents, excessive maintenance, EH&S deficiencies	Aged, deteriorated, unreliable roofs	Phased Roof Replacement Program	Roof Replacements, Phase III	1,2,5	Line Item proposed (MEL-FS/KG-01)	9.0?FY02
Defective building systems threaten life safety, operational shutdowns	Building systems do not meet current standards for safe, reliable operation	Replace, repair and upgrade defective building systems	Building Systems Upgrade, Phase II Buildings 64, 75, 79, 88	1,2,3,5	Line Item (MEL-FS/KG-02)	10.9?FY05

*Project Categories.

1. Correction of deficiencies in structural, mechanical, electrical and other support and infrastructure systems to ensure safety and health of employees, visitors and the general public in compliance with environmental regulations.
2. Repair and rehabilitation of support facilities, including equipment and infrastructure to assure continued cost effective use, prevent deterioration and protect the national investment.
3. Modification or addition to existing support facilities to ensure their capacity and technological capability to meet the needs of new or expanded programs.
4. Modification or addition to existing support facilities to incorporate and consolidate operations that are uneconomically separated, dispersed or housed in obsolete, deteriorated or temporary buildings.
5. Replacement and removal of old, deteriorated and outmoded support facilities which can no longer be economically upgraded, maintained, and operated.

Table 3-14. Assets List, Buildings, Functional Unit 15 (Research and Development Buildings).

Prop. ID	Prop. Name	Area (gsf)	Cost ($K) Orig	Imprv	Total	CPV[1] ($K)	RPV[2] ($K)	Age	DSG Life	Useful Life[3] Curr	w/Defic Corrc	Cond[4]
DOE-Owned Buildings (Berkeley Lab Site)												
2	AML,AFR,CXRO,CS,EE,MS	85820	22453	-8	22445	27217	34585	6	50	44	NA	1
4	Magnetic Fusion Energy	10116	127	141	268	2168	4077	50	25	10	NA	3
5	Magnetic Fusion Energy (MFE)	666	8	49	57	140	268	44	50	10	NA	3
10	LS Lab, Photogrphy, Photo Lab	15873	92	356	448	2201	6397	50	25	10	NA	3
14	Accel & Fusion Rsch, Earth Sci	4200	14	39	53	332	1693	50	25	10	NA	3
16	Magnetic Fusion Energy Lab	11288	44	243	287	1121	4549	50	50	10	NA	3
17	Envmtl Health & Safety	2065	23	1	24	211	832	45	50	10	NA	3
27	Hi Voltg Tst Facil, Cable Shop	3288	13	39	52	318	1325	46	50	10	NA	3
40	Electronics Development Lab	952	2	7	8	27	384	47	25	10	NA	3
41	Communications Eng'g & Elecncs	995	2	7	9	26	401	46	25	10	NA	3
44	Indoor Air Pollution Study	800	7	0	7	43	322	38	25	5	NA	3
46	ALS, Accelerator Electronics	53452	152	623	775	3037	21541	45	50	15	40	2
46A	Systems Engineering	5504	194	0	194	394	2218	17	25	15	40	2
47	Advanced Accelerator Studies	6098	99	147	246	1177	2457	37	50	15	NA	3
50	AFR, Copy Ctr, Library, Phys	47479	941	582	1524	9975	19134	45	50	15	40	2
50B	ICS, Com&Ntwk, Tele Svcs, Phys	63529	2311	1161	3472	13034	25602	27	50	20	40	2
52	Magnetic Fusion Energy Lab	6542	24	82	106	368	2636	45	50	10	NA	3
53	SupHILAC Dvlp, Mag Dvlp, Mevva	6426	50	34	84	494	2590	45	50	10	NA	3
55	Life Sciences	18678	145	2327	2472	5211	7527	42	50	20	40	2
55A	Nuclear Magnetic Resonance	1535	0	0	0	0	619	10	25	15	NA	2
58	Heavy Ion Fusion	10629	96	55	152	905	4283	43	50	10	20	3
58A	Accel Rsch And Dvlpmt Addition	11484	223	360	583	1513	4628	24	50	26	40	2
60	High Bay Laboratory	3400	354	0	354	575	1370	14	50	36	50	2
62	Materials And Chemical Science	55626	1744	800	2543	10515	22417	29	50	20	40	2
63	Accelerator And Fusion Rsch	2624	18	9	27	139	1057	31	20	5	NA	3
64	Accelerator And Fusion Rsch	23943	237	320	557	3376	9649	43	50	20	40	2
66	SSCL, CAM, CS, MS	44123	9541	81	9622	11919	17782	7	50	43	NA	1

Table 3-14. Assets List, Buildings, Functional Unit 15 (Research and Development Buildings).

Prop. ID	Prop. Name	Area (gsf)	Cost ($K) Orig	Imprv	Total	CPV[1] ($K)	RPV[2] ($K)	Age	DSG Life	Useful Life[3] Curr	w/Defic Corrc	Cond[4]
70	Nuclear Sci, Energy & Env	62432	1462	2659	4121	14110	25160	39	50	15	40	2
70A	Nuclear Sci, Life Sci	67789	1860	1896	3756	13681	27319	33	50	15	40	2
72	Nat'l Ctr Electron Microscopy	6105	121	46	168	907	2460	33	50	15	40	2
72A	High Volt Electron Microscope	2532	657	0	657	1066	1020	14	50	36	NA	2
72B	Atomic Resolution Microscope	4413	1279	0	1279	1666	1778	10	50	40	NA	1
72C	Arm Support Laboratory	5335	1143	0	1143	1489	2150	10	10	10	20	1
73	Atmospheric Aerosol Research	4228	89	157	245	1009	1704	33	25	10	20	2
74/74B	Lif Sci Lab/ Lif Sci Lab Annex	48870	485	4620	5105	12713	19695	32	50	20	40	2
75	Radiso Svcs,Natl Trit Labl Fac	8545	105	422	527	1939	3444	33	50	20	40	2
83	Life Sciences Laboratory	6995	1036	43	1079	1845	2819	15	50	20	40	2
B-51N	Bevalac Patient Facility	645	0	0	0	0	260	?	20	NA	NA	2
	Subtotals, DOE-Owned Blds (Berkeley Lab Site)	715024	47148	17301	64450	146864	288155					
DOE-Owned Experimental Facilities (Berkeley Lab Site)												
B-51F	HISS Building	1495	13	0	13	23	602	15	10	5	15	3
B-51G	HISS Building	1440	22	0	22	39	580	15	10	5	15	3
	Subtotals, DOE-Owned Exptl Facil (Berkeley Lab Site)	2935	36	0	36	62	1183					
DOE-Owned Trailers (Berkeley Lab Site)												
B-3A	Melv Calv (B3) Roof Trlr	756	26	0	26	77	187	22	10	5	NA	3
B-3B	Melv Calv (B3) Roof Modular	532	0	0	0	0	132	?	10	5	NA	3
B-67C	Laboratory	1237	33	0	33	62	307	16	10	5	NA	3
B-75B	Env Health & Safety	4681	182	0	182	315	1161	15	10	5	NA	3
B-75E	Tritium Group	410	0	0	0	0	102	?	10	5	NA	3
B-83A	Laboratory	493	9	0	9	45	122	28	10	5	NA	3
	Subtotals, DOE-Owned Trlrs (Berkeley Lab Site)	8109	250	0	250	499	2011					
	Subtotals, DOE-Owned	726068	47434	17301	64735	147425	291349					
Leased (Off-Site)												
934	Dymo: Printing Plant, LS	30720	0	0	0	0	12380	NA	NA	NA	NA	NA
	Subtotals, Leased (Off-Site)	30720	0	0	0	0	12380					
	Subtotals, Leased	30720	0	0	0	0	12380					

Table 3-14. Assets List, Buildings, Functional Unit 15 (Research and Development Buildings).

Prop. ID	Prop. Name	Area (gsf)	Cost ($K) Orig	Imprv	Total	CPV[1] ($K)	RPV[2] ($K)	Age	DSG Life	Useful Life[3] Curr	w/Defic Corrc	Cond[4]
UC-Owned (Off-Site)												
1	Donner Lab	25607	0	0	0	0	10320	NA	NA	NA	NA	NA
3	Melvin Calvin	22436	0	0	0	0	9042	NA	NA	NA	NA	NA
8	Hearst Mining	18512	0	0	0	0	7460	NA	NA	NA	NA	NA
11	Hildebrand	14822	0	0	0	0	5973	NA	NA	NA	NA	NA
18	Gilman	9796	0	0	0	0	3948	NA	NA	NA	NA	NA
19	Le Conte	3580	0	0	0	0	1443	NA	NA	NA	NA	NA
19A	Birge	14353	0	0	0	0	5784	NA	NA	NA	NA	NA
20A	Lsb Addition	660	0	0	0	0	266	NA	NA	NA	NA	NA
21	Giauque	9500	0	0	0	0	3828	NA	NA	NA	NA	NA
22	Latimer	13736	0	0	0	0	5536	NA	NA	NA	NA	NA
24	Etcheverry	2369	0	0	0	0	955	NA	NA	NA	NA	NA
38	Lewis	6254	0	0	0	0	2520	NA	NA	NA	NA	NA
39	Cory	511	0	0	0	0	206	NA	NA	NA	NA	NA
177	RFS, Radon Rsch Hse	2099	0	0	0	0	846	NA	NA	NA	NA	NA
180	RFS, Ind Air Qual Lab	3693	0	0	0	0	1488	NA	NA	NA	NA	NA
905	Hesse	5887	0	0	0	0	2372	NA	NA	NA	NA	NA
921	Stanley	1498	0	0	0	0	604	NA	NA	NA	NA	NA
983	Wurster	4998	0	0	0	0	2014	NA	NA	NA	NA	NA
984	Davis	906	0	0	0	0	365	NA	NA	NA	NA	NA
987	Warren	433	0	0	0	0	174	NA	NA	NA	NA	NA
990	Evans	195	0	0	0	0	79	NA	NA	NA	NA	NA
995	Barker	2155	0	0	0	0	868	NA	NA	NA	NA	NA
	Subtotals, UC-Owned (Off-Site)	164000	0	0	0	0	66092					
UC-Owned (Berkeley Lab Site)												
5	MFE (Portion University-Owned)	6483	0	0	0	0	2613	NA	NA	NA	NA	NA
	Subtotals, UC-Owned (Berkeley Lab Site)	6483	0	0	0	0	2613					
	Subtotals, UC-Owned	170483	0	0	0	0	68705					
	Totals, Research & Development	**927271**	**47434**	**17301**	**64735**	**147425**	**372433**					

[1]CPV calculated by individually escalating and summing acquisition and improvement costs using *Engineering News Record's* annual average Building Cost Index to determine escalation factor.

[2]RPV calculated at: 310$/SF (Administrative), 259$/SF (Storage), 362$/SF (Production), 362$/SF (Service), 403$/SF (R&D), 445$/SF (Accel), 248$/SF (Trailers) using August 1993 escalation rate of 3.4% for 1994.

[3]Useful life based on best engineering estimate.

[4]**Rehab Status 1** = Adequate **Rehab Status 2** = Approaching technological and functional obsolescence but can be economically upgraded to adequate space. **Rehab Status 3** = Substandard buildings and temporary trailers that have aged beyond their useful life. Not economically feasible to upgrade to current environmental health and safety standards or functional adequacy.

Significant programmatic initiatives in basic energy sciences, health and environmental research, and energy efficiency and renewable energy also impact the needs for and uses of capital assets in this functional unit. Deficiencies and requirements for this functional unit are summarized in the Functional Unit 15 Life Cycle Chart, Table 3-15.

Functional Unit 16 — Accelerator Buildings

Buildings in this functional unit house accelerators and staging or development activities directly related to experimental accelerators. Functional Unit 16 does not include buildings that house accelerators that are working components of a larger apparatus such as a large electron microscope. Buildings in this functional unit are all on-site and are listed in Table 3-16.

Two recent developments will have a major impact on the inventory of accelerator buildings: completion of the ALS project and decommissioning of the Bevalac. The ALS came on line in FY 1993. The ALS is a national users facility which, although funded for an initial complement of users' offices and support facilities, will expand dramatically over the next several years.

The other activity is the planned decommissioning of the Bevalac, which is the combination of two major accelerators, the SuperHILAC and the Bevatron, and a particle beam transfer system between them. These two accelerators will be decommissioned. Final disposition of the major buildings which house them is yet to be determined. Other R&D activities are now under planning consideration. Existing buildings in the SuperHILAC (Building 71) and Bevatron (Building 51) complexes include extremely valuable and extensive electrical and mechanical support systems, heavy cranes, and high bay space, most of which can be classified as adequate when the accelerators are removed. Deficiencies and requirements for this functional unit are summarized in the Functional Unit 16 Life Cycle Chart (Accelerator Buildings), Table 3-17.

Functional Unit 30 — Transportation Systems

This functional unit is primarily composed of secondary roads, sidewalks, parking spaces, one bridge on-site, and leased parking off-site to serve off-site leased office space. Table 3-18 gives a more specific list of these assets.

Roadways within Berkeley Lab were primarily established during the 1940's (with minor additions in the 1950's) during World War II when the Laboratory was in its infancy and vehicular and pedestrian traffic were minimal. Generally, roads are steep, narrow, winding mountain roadways with sections of poor vertical and horizontal sight distances. In many areas pedestrian and vehicular traffic are too close for safety. Modern traffic loadings have overtaxed the minimal foundation materials originally laid down causing subgrade failures and surface deterioration. Drainage systems are inadequate and existing landslides threaten roadway stability.

Parking is also a significant operational problem on the hilly Berkeley Lab site. Most relatively flat areas suitable for parking development have been used for buildings, other structures and roadways. Potential off-site parking is exceedingly remote and expensive to lease. Although Berkeley Lab has carried out an extensive program to urge employees to use public transportation for commuting to work, physical conditions of the site terrain and other natural conditions combine to constrain the success of the program. Visitors, contractors and suppliers have great difficulty finding timely or convenient parking to carry out business. Parking along Berkeley Lab roads is unsightly and creates safety problems. Roads have been converted to one-way to allow parking lanes. This creates inefficient circulation, congestion and safety problems. The Pedestrian Circulation System project will separate pedestrians from vehicles.

The development of user beam lines at the ALS will bring up to 250 additional full-time visitor users to Berkeley Lab who will need parking either on-site or leased off-site. If leased off-site parking is required, Berkeley Lab's busing costs will also increase. Deficiencies and requirements for this functional unit are summarized in the Functional Unit 30 Life Cycle Chart (Transportation Systems), Table 3-19.

Table 3-15. Functional Unit 15 Life Cycle Chart (R&D Buildings).

Event Problem/Need	Deficiencies	Existing Requirements	Project Title	Legislative Need*	Funding Type	TEC $M
TSA and Tiger Team findings to improve fire and safety safeguards	Fire and Safety Systems aged and noncompliant with current code and practice	Modernize and correct existing facilities to improve fire and safety systems	Fire and Safety Systems Upgrade Project, Phase I	1,2,3	Line Item (MEL-FS/KG-02)	4.6 FY93
Insufficient safety, health and environmental safeguards for aged materials and chemical sciences research and support laboratories in various buildings	Aged lab facilities do not meet current regulations and codes for using hazardous materials in current research programs.	Phase 1 project will correct building and fire code deficiencies in Building 70 (62,237 GSF).	Hazardous Materials Safeguards, Phase I	1,2,3	Line Item (MEL-FS/KG-02)	4.7 FY93
Expanding DOE program in molecular genetics. Need for high tech research facility.	Existing space is inadequate in quality and quantity. Dispersed program activities.	41,000 GSF new light lab space for multi-disciplinary scientific teams.	Human Genome Laboratory	1,3,4	Line Item (KP)	24.7 FY94
Lack of facilities for new molecular beams initiative at the ALS for chemical dynamics research.	No existing labs which can fulfill special requirements for proposed program.	33,000 GSF research lab for interactive use of molecular beams with ALS beams.	Chemical Dynamics Research Lab	3	Line Item (KC)	61.9 FY96
Mechanical equipment failures, shutdowns, excessive maintenance	Aged, deteriorated, unreliable mechanical equipment sitewide. Bldg and EH&S Code deficiencies	Replace aged, deteriorated and uneconomical mechanical equipment on phased priority basis	Mechanical Equipment Replacement, Phase I	1,2,3,5	Line Item proposed (MEL-FS/KG-01)	4.5 FY96
Need for electron beam microcharacterization instrumentation at the National Center for Electron Microscopy	Lack of lab space and support instrumentation for DOE users of NCEM.	10,000 GSF lab and offices, 400 kV in-situ microscope, z-contrast STEM at Bldg. 72	NCEM Electron Beam Microcharacterization Facility	3	Line Item Proposed (KC)	15.9 FY96
Roof failures, damaged contents, excessive maint., EH&S deficiencies	Aged, deteriorated, unreliable roofs sitewide	Phased roof repl. program sitewide	Roof Replacements, Phase II	1,2,5	Line Item (MEL-FS/KG-01)	7.5 FY98
Insufficient safety, health and environmental safeguards for aged research facilities in various buildings.	Aged lab and shop facilities do not meet current regulations and codes for use of hazardous materials in current research programs.	Phase II project will correct building and fire code deficiencies in various laboratory and shop areas.	Hazardous Materials Safeguards, Phase II	1,2,3	Line Item (MEL-FS/KG-02)	8.1 FY99

Table 3-15. Functional Unit 15 Life Cycle Chart (R&D Buildings).

Event Problem/Need	Deficiencies	Existing Requirements	Project Title	Legislative Need*	Funding Type	TEC $M
Inadequate fire and safety protection	Aged, deteriorated fire and safety systems. Lack of compliance with new codes and regulations	Phased upgrading program	Fire & Safety Systems Upgrade Project, Phase II	1,2,3	Line item (MEL-FS/KG-02)	5.7 FY99
Modular, low cost space to accommodate rapid changes in new research and applied science.	Six year lead time to provide general lab space for emerging R&D Initiatives	20,500 GSF of highly flexible low-cost lab space in close proximity to existing support facilities and utilities	Research Incubator Facility	3,4,5	Line Item Proposed (MEL-FS/KG-01)	17.8 FY00
Need to upgrade and modernize laboratory services in existing buildings	Unreliable, deteriorated systems in older buildings which service programmatic activities	Phased upgrading program for building services, air, water, natural gas, HVAC waste systems	Building Systems Upgrade, Phase I Bldgs. 90, 50, 50B	1,2,3,5	Line Item Proposed (MEL-FS/KG-02)	12.0 FY01
TSA and Tiger Team finding to improve fire and safety safeguards	Fire and Safety Systems aged and noncompliant with current code and practice	Modernize and correct existing facilities to improve fire and safety system	Fire and Safety systems Upgrade Project, Phase III	1,2,3,5	Life Item Proposed (MEL-FS/KG-02)	5.8 FY01
Mech. Equip. failures, shut downs, excessive maint., EH&S deficiencies	Aged, deteriorated, unreliable mech. equip. sitewide	Phased capital equip. replacement program sitewide	Mech. Equip. Upgrade, Phase II	1,2,3,5	Line Item Proposed (MEL-FS/KG-01)	5.8 FY01
Need for space to accommodate and consolidate expanded Applied Sciences	Insufficient, dispersed substandard space in temporary and technologically obsolete buildings	44,600 GSF of light lab, office and related equipment and instrumentation	Applied Science Building	1,3,4,5	Line Item Proposed (MEL-FS/KG-01)	26.8 FY04
Potential seismic hazards incl. hazardous matls, potential injury to people and property damage	Substandard seismic resistance, building equip., nonstructural elements and contents	Sitewide analysis and upgrading of building equip. and contents	Non-Structural Seismic Safety Improvement Project	1,2	Line Item Proposed (MEL-FS/KG-02)	5.4 FY03

*Project Categories.

1. Correction of deficiencies in structural, mechanical, electrical and other support and infrastructure systems to ensure safety and health of employees, visitors and the general public in compliance with environmental regulations.
2. Repair and rehabilitation of support facilities, including equipment and infrastructure to assure continued cost effective use, prevent deterioration and protect the national investment.
3. Modification or addition to existing support facilities to ensure their capacity and technological capability to meet the needs of new or expanded programs.
4. Modification or addition to existing support facilities to incorporate and consolidate operations that are uneconomically separated, dispersed or housed in obsolete, deteriorated or temporary buildings.
5. Replacement and removal of old, deteriorated and outmoded support facilities which can no longer be economically upgraded, maintained, and operated.

Table 3-16. Assets List, Buildings, Functional Unit 16 (Accelerator Buildings).

Prop. ID	Prop. Name	Area (gsf)	Cost ($K) Orig	Imprv	Total	CPV[1] ($K)	RPV[2] ($K)	Age	DSG Life	Useful Life[3] Curr	w/Defic Corrc	Cond[4]
DOE-Owned Buildings (Berkeley Lab Site)												
6	Advd Light Source (ALS)	96528	21016	0	21016	22852	42955	1	50	49	NA	1
51/51A,B	Bevlc/Bevtn, Bev Exptl, EPB	156411	1416	4560	5976	28870	69603	44	50	10	40	2
71/71B	HILAC/HILAC Annex	63859	449	4122	4571	13038	28417	38	50	20	40	2
80	AFR, Electronics Eng'g	26471	241	701	942	3327	11780	40	50	20	40	2
88	88" Cyclotron, Nuclear Sci	50713	1327	1449	2776	11231	22567	34	50	20	40	2
	Subtotals, DOE-Owned Blds (Berkeley Lab-Site)	393982	24449	10833	35281	79318	175322					
	Subtotals, DOE-Owned	393982	24449	10833	35281	79318	175322					
UC-Owned (Berkeley Lab Site)												
6	ALS (Portion University-Owned)	20800	0	0	0	0	9256	NA	NA	NA	NA	NA
	Subtotals, UC-Owned (Berkeley Lab-Site)	20800	0	0	0	0	9256					
	Subtotals, UC-Owned	20800	0	0	0	0	9256					
	Totals, Reactor and Accelerator	414782	24449	10833	35281	79318	184578					

[1]CPV calculated by individually escalating and summing acquisition and improvement costs using *Engineering News Record's* annual average Building Cost Index to determine escalation factor.

[2]RPV calculated at: 310$/SF (Administrative), 259$/SF (Storage), 362$/SF (Production), 362$/SF (Service), 403$/SF (R&D), 445$/SF (Accel), 248$/SF (Trailers) using August 1993 escalation rate of 3.4% for 1994.

[3]Useful life based on best engineering estimate.

[4]**Rehab Status 1** = Adequate **Rehab Status 2** = Approaching technological and functional obsolescence but can be economically upgraded to adequate space. **Rehab Status 3** = Substandard buildings and temporary trailers that have aged beyond their useful life. Not economically feasible to upgrade to current environmental health and safety standards or functional adequacy.

Table 3-17. Functional Unit 16 Life Cycle Chart (Accelerator Buildings).

Event Problem/Need	Deficiencies	Existing Requirements	Project Title	Legislative Need*	Funding Type	TEC $M
Expanding life sciences research for national users of the Advanced Light Source (ALS)	Lack of high tech biological support facilities in close proximity to life science activities at the ALS.	Finish and outfit 5,100 GSF in existing Building 6, the ALS; modify 6,000 GSF in existing Building 80.	ALS Structural Biology Support Facilities	1,2,3,4	Line Item (KC) funded	7.9 FY94
Expanding research objectives for materials and surface sciences for national users of the ALS.	Lack of sufficient insertion devices, beamlines and support space to fulfill planned research objectives.	Extraction devices for four beamlines plus outfitting 20,000 GSF of existing ALS space in Building 6 as support laboratories and offices for national users.	ALS Beamlines Initiative	3,4	Line Item (KC) proposed	52.6 FY95

*Project Categories.

1. Correction of deficiencies in structural, mechanical, electrical and other support and infrastructure systems to ensure safety and health of employees, visitors and the general public in compliance with environmental regulations.
2. Repair and rehabilitation of support facilities, including equipment and infrastructure to assure continued cost effective use, prevent deterioration and protect the national investment.
3. Modification or addition to existing support facilities to ensure their capacity and technological capability to meet the needs of new or expanded programs.
4. Modification or addition to existing support facilities to incorporate and consolidate operations that are uneconomically separated, dispersed or housed in obsolete, deteriorated or temporary buildings.
5. Replacement and removal of old, deteriorated and outmoded support facilities which can no longer be economically upgraded, maintained, and operated.

Table 3-18. Assets List, Other Structures and Facilities (OSF), Functional Unit 30 (Transportation systems).

Prop. Name	Size/Capacity		Original Cost
936 Parking, GW Bldg. Garage (Leased)	612	Sqyd	NA
All Other, Parking Areas	38,375	Sqyd	$1,258,480
All Other Sidewalks	5,250	Linft	$667,897
Roads and Bridge, Paved	5.5	Linmi	$2,712,413
Total, Transportation Systems			**$4,638,790**

Table 3-19. Functional Unit 30, Transportation systems, Life Cycle Chart.

Event Problem/Need	Deficiencies	Existing Requirements	Project Title	Legislative Need*	Funding Type	TEC $M
Unsafe and unstable portions of on-site roadway system and related pedestrian circulation	Poor roadway subgrade capacities, short sight distances, steep, narrow lanes and unstable landslide sections	Widening and realignment of Berkeley Lab entrance roads and main intersections. Stabilization of threatening landslide area.	Roadway Safety & Stabilization Phase I	1,2,3,4	Line Item Proposed (MEL-FS/ KG-02)	6.8 FY96
Need for parking space for ALS national users and Berkeley Lab staff in vicinity of ALS, AML and ALS Structural Biology Program	Lack of space for ground level parking on-site. Lack of off-site, leased parking within 3 miles of Berkeley Lab gates.	136 parking spaces in the vicinity of the ALS-AML complex	"Old Town" Parking Structure	1,2,4,5	Line Item Proposed (MEL-FS/ KG-01)	2.9 FY97
Need for safe parking in Central Research and Administrative area to accommodate program and support activities. Need to eliminate unsafe roadway parking.	Lack of space for ground level parking on-site. Lack of off-site leased parking within 3 miles of Berkeley Lab gates. Unsafe existing parking on steep, narrow winding roads.	1054 new parking spaces, removal of 466 unsafe parking spaces. Eliminate parallel parking both sides of one-way roads.	Blackberry Canyon Parking Structure	1,2,4,5	Line Item Proposed (MEL-FS/ KG-01)	22.2 FY98
Need to improve road load bearing capacity, alignment, vehicular and pedestrian safety	Low load capacities, short sight distances, narrow lanes, steep grades, excessive maintenance costs.	Widening and strengthening roadbeds for two-way traffic.	Roadway Safety & Stabilization, Phase II	1,2,3,5	Line Item Proposed (MEL-FS/ KG-02)	7.7 FY01
Need to improve safety, capacity, and efficiency of on-site road system	Sections of main transportation arteries are narrow single-lane roads with poor sight distance; some have poor stability.	Widening and strengthening roadbeds for two-way traffic.	Roadway Safety & Stabilization, Phase III		Line Item Proposed (MEL-FS/ KG-02)	9.7 FY05

*Project Categories.

1. Correction of deficiencies in structural, mechanical, electrical and other support and infrastructure systems to ensure safety and health of employees, visitors and the general public in compliance with environmental regulations.
2. Repair and rehabilitation of support facilities, including equipment and infrastructure to assure continued cost effective use, prevent deterioration and protect the national investment.
3. Modification or addition to existing support facilities to ensure their capacity and technological capability to meet the needs of new or expanded programs.
4. Modification or addition to existing support facilities to incorporate and consolidate operations that are uneconomically separated, dispersed or housed in obsolete, deteriorated or temporary buildings.
5. Replacement and removal of old, deteriorated and outmoded support facilities which can no longer be economically upgraded, maintained, and operated.

Functional Unit 31 — Other Known Assets

This functional unit contains assets not listed in other functional units, specifically, miscellaneous site improvements, retaining walls and fencing. Table 3-20 lists these assets.

Generally, fencing is a constant maintenance problem at Berkeley Lab because of the inherent ruggedness of the terrain and the presence of heavy, silty surface materials that creep downhill. Miscellaneous site improvements and retaining walls are generally adequate. Retaining walls and other site improvements that were part of a larger project were capitalized with the related project and are not listed here.

Included are two special items, the fire sprinkler systems that DOE installed in two UC Berkeley Campus Buildings, Donner Laboratory and Calvin Laboratory, to protect DOE programmatic assets.

The Slope and Seismic Stabilization project is a major project recently completed. Major tie-back retaining walls and drainage systems stabilize two large ancient landslide bodies that could damage major Berkeley Lab buildings if triggered by a strong earthquake. These improvements are listed under this functional unit. No other significant event or projects are planned which would be part of Functional Unit 31. The life cycle chart for this functional unit is still being developed and will appear in a future edition of the CFP.

Table 3-20. Assets List, Other Structures and Facilities (OSF), Functional Unit 31 (Other Known Assets).

Prop. Name	Size/Capacity	Original Cost
Cowell Hospital Imprvmt	1 Each	$19,163
Donner Laboratory Sprinkler System	1 Each	$235,409
Fencing	19,923 Linft	$200,084
Melvin Calvin Laboratory Sprinkler System	1 Each	$147,468
Misc Assets	212 Each	$73,847
Misc Site Improvements	1 Each	$4,364,009
Retaining Walls	12 Each	$206,630
	Total, Other Known Assets	**$5,246,610**

Functional Unit 33 — Storage

This functional unit is composed of storage tanks for liquid and gas, the most costly assets being two 230,000 gallon on-site water storage tanks and integral emergency pumping stations which were constructed about 20 years ago to provide on-site water supplies for fire sprinklers in the event off-site municipal supplies are lost in a damaging earthquake. Table 3-21 lists assets in this functional unit.

The condition of the assets in this functional unit is adequate; however, expansion of the Berkeley Lab site and increased building assets in Upper Strawberry Canyon have increased the need for an additional water storage tank to protect these assets. The life cycle chart for this functional unit is still being developed and will appear in a future edition of the CFP.

Functional Unit 34 — Industrial/ Production/Process

This functional unit contains waste treatment systems, cooling towers, heat exchangers, chilled water plants, and stand-by electrical generators associated with individual plants that are not an integral part of a specific building. Table 3-22 lists assets in this functional unit.

Table 3-21. Assets List, Other Structures and Facilities (OSF), Functional Unit 33 (Storage).

Prop. Name	Size/Capacity	Original Cost
B82 , 68 Pump House Water Tanks (2)	400,000 Gal	$30,938
Inter. Press. Helium Gas Sp	15,000 Each	$31,946
Stor. Gas Tank	4,780 Cft	$264,693
Storage, Water Tanks (2)	460,000 Gal	$732,373
Storage Wtr Tanks	90,000 Gal	?
Waste Storage Tank SW 69	2,000 Gal	$5,320
	Total Storage	**$1,065,270**

Table 3-22. Assets List, Other Structures and Facilities (OSF), Functional Unit 34 (Industrial Production/Process).

Prop. Name	Size/Capacity	Original Cost
B37 Cooling Tower Building	1 Each	$3,865,027
Chiller	10,000 Tons	?
Cooling Tower	8,055 Tons	$1,946,296
Cooling Towers	5,853 Tons	?
Cooling-Tower	1,550 Tons	?
Heat Exchangers	8,400 Tons	?
Heat Exchangers	1,600 Tons	?
Indst/Hazard Waste Treat.	10,000 Gpd	$60,000
Var.St.-By Elec. Generator	280 kVA	$61,602
Var. Stand-By Elec. Generat	970 kVA	?
Var. Stand-By Elec. Genratr	115 kVA	?
Var. Stand/By Elec. Genratr	600 kVA	$78,256
	Total, Industrial/Production/Process	**$6,011,181**

These assets are vital to the operations they serve and provide important backup for safety, health and environmental protection. A significant percentage of these assets are aged and will require replacement over the next several years. Some stand-by generators need to be upgraded to emergency generators to meet new regulatory requirements.

During the next several years the Bevalac will be decommissioned. The Bevalac is served by major cooling tower plants that include chillers, related power supplies and stand-by generators, all of which are aged. At this time the future use of these facilities is unknown, but a number of initiatives are being considered. The life cycle chart for this functional unit is still being developed and will appear in a future edition of the CFP.

Functional Unit 35 — Service Structures

This functional unit is primarily composed of miscellaneous service structures that house a power supply, emergency generator, telephone terminal or similar service. Table 3-23 lists these assets.

These assets vary greatly in condition, but present no significant problem other than routine maintenance. The life cycle chart for this functional unit is still being developed and will appear in a future edition of the CFP.

Table 3-23. Assets List, Other Structures and Facilities (OSF), Functional Unit 35 (Service Structures).

Prop. Name	Size/Capacity	Original Cost
Centrex Terminal Structur	1 Each	$40,000
Mg House	1 Each	$9,933
Misc Serv Structures	1 Each	$287,368
Ower Supply Shelter 71A	1 Each	$83,258
	Total Services Structures	**$420,559**

Table 3-24. Assets List, Other Structures and Facilities (OSF), Functional Unit 36 (Communications and Security).

Prop. Name	Size/Capacity	Original Cost
All Other Monitoring Syst	1 Each	$148,204
Cables, Undergrd (Fire Alarm)	25,000 Linft	$1,030,402
Cables, Undergrd (Voice/Data)	35,000 Linft	$262,914
Comm./Fixed Uhf Radio Tra	12 Each	?
Comm/Paging System	70 Each	?
Comm/Security Card Entry	85 Each	?
Communication Engineering	1 Each	$11,232
Energy Mon&Control System	500 Pts	$276,288
Integ Comm Sys, Undgd Voice/Data Cables	80,000 Linft	$2,077,667
Integ Comm Sys, Voice/Data Swch Sta	4 Each	$4,155,333
	Total, Communications and Security	**$7,962,040**

Functional Unit 36 — Communications Type Systems

This functional unit is composed of various communication systems that service the Berkeley Lab site. These include the fire alarm system, the energy monitoring and control system, the public address system, the security card entry system and the Integrated Communication System (ICS), which includes the main telephone switch for the Laboratory. The ICS was lease-purchased. It has not been fully paid for; therefore, it has not been capitalized as yet. However, it is listed here because it has been in use for several years and is the most valuable asset in this functional unit. These assets, including miscellaneous minor systems, are listed in Table 3-24.

Generally, these assets are adequate but are constantly being expanded or modified because of increasing use or changes in technology, codes or regulations. Deficiencies and requirements for this functional unit are summarized in Functional Unit 36 Life Cycle Chart (Communications Type Systems), Table 3-25.

Table 3-25. Functional Unit 36 Life Cycle Chart (Communications Type Systems).

Event Problem/Need	Deficiencies	Existing Requirements	Project Title	Legislative Need*	Funding Type	TEC $M
Need to modernize conduit infrastructure for expanding sitewide communications, fire alarm and computer network.	Aged, deteriorated, substandard site-wide conduit infrastructure inadequate to support modern communications technology.	Restoration and improvements to conduit infrastructure to meet new physical and technological standards	Communications Conduit Infrastructure Improvements	1,2,3,5	Proposed Line Item (MEL-FS/ KG-01)	3.8 FY97
Need for upgrade of Berkeley Lab's Radio Communications System	Technological obsolescence and lack of full site coverage	Two radio towers, related equipment and enclosures including emergency back-up	Upgrade Radio Communications System	1,2,3,5	Proposed Line Item (MEL-FS/ KG-02)	4.7 FY97

*Project Categories.

1. Correction of deficiencies in structural, mechanical, electrical and other support and infrastructure systems to ensure safety and health of employees, visitors and the general public in compliance with environmental regulations.
2. Repair and rehabilitation of support facilities, including equipment and infrastructure to assure continued cost effective use, prevent deterioration and protect the national investment.
3. Modification or addition to existing support facilities to ensure their capacity and technological capability to meet the needs of new or expanded programs.
4. Modification or addition to existing support facilities to incorporate and consolidate operations that are uneconomically separated, dispersed or housed in obsolete, deteriorated or temporary buildings.
5. Replacement and removal of old, deteriorated and outmoded support facilities which can no longer be economically upgraded, maintained, and operated.

Functional Unit 37 — Distribution Systems

This functional unit is composed of electrical power transformers and substations, pumping plants, compressed air plants and their distribution systems, the natural gas distribution system, and the industrial and sanitary waste systems. Table 3-26 lists these assets.

Generally, Berkeley Lab's utility systems were sized to serve large accelerators, and have the capacity to fulfill present and future electrical power, gas, water, and sanitary waste requirements. However, changing programs and new construction initiatives often result in significant changes to distribution systems. Also, many segments and load centers are aged and now require major rehabilitation and/or replacement to forestall failure, improve reliability, meet new regulations, or reduce costly maintenance that is inherent in aged distribution systems.

Also, the expansion of building assets into upper Strawberry Canyon will necessitate improvements in water supply redundancy to ensure protection of major investments and hazardous waste handling operations in that area. Deficiencies and requirements for this functional unit are summarized in Functional Unit 37 Life Cycle Chart (Distribution Systems), Table 3-27.

Functional Unit 38 — Accelerators

This functional unit includes Berkeley Lab accelerators that are major scientific instruments used for research experiments. This functional unit does not include accelerators that are components of other research apparatus such as electron microscopes. Table 3-28 lists the assets in Functional Unit 38.

Recent events have had significant impact on the assets of this functional unit, including startup of the ALS and eventual decommissioning of the Bevalac. The ALS came on line in FY 1993 and is listed under this functional unit. Major programmatic initiatives which will become major assets in this functional unit are listed in Functional Unit 38 Life Cycle Chart (Accelerators), Table 3-29.

The Bevalac was shut down in February 1993 and will be decommissioned during the next several years. Until decommissioned the Bevalac will remain on the asset list for Functional Unit 38. The final disposition of the accelerator buildings that provided housing for the Bevalac accelerators is yet to be determined.

Table 3-26. Assets List, Other Structures and Facilities (OSF), Functional Unit 37 (Distribution Systems).

Prop. Name	Size/Capacity		Original Cost
12kv Line To Chemistry 70	1.5	Linmi	$428,539
12kv Primary Distribution	16	Linmi	$2,818,074
12kv Primary To E. Canyon	2	Linmi	$308,293
12kv Primary/Orig.Lab Sit	1	Linmi	$154,147
B36 Grzly Substa (50,000 Kva)	50,000	kVA	$249,017
Big C Switch Sta.Capacito	3,000	kVA	$340,112
Bldg. 16 Substation	5,000	kVA	
Bldg51 Capacitor Bank	3,000	kVA	
Building 58 Substation	3,000	kVA	$24,481
Building 6 Substation	6,000	kVA	$455,525
Building 77 Substation	2,000	kVA	$16,304
Building 88 Substation	2,000	kVA	$96,226
Compressd. Air Distributi	5,000	Linft	
Compressd Air Distributio	6,238	Linft	$1,399,693
Comprsd Air Distribution	2,367	Linft	
Elec. Substations 50a&50b	2,000	kVA	
Electric Substations	20,500	kVA	$374,864
Electric Substations B	19,000	kVA	$67,965
Electrical Cables, Secondary	22.73	Linmi	$51,735
Gas Distr.Sys. Lines	9,000	Linft	$1,305,220

Table 3-26. Assets List, Other Structures and Facilities (OSF), Functional Unit 37 (Distribution Systems).

Prop. Name	Size/Capacity		Original Cost
Gas Distribution Sys.Line	11,100	Linft	$199,960
Gas Tank&Pump Facil.By 76	20	Gpm	$9,882
Ind.Hazard Waste Dist.Lin	1,000	Linft	$58,497
Sewage Coll. Sys.Gravity	10,000	Linft	$284,382
Sewage Collect.Sys.Gravit	14,600	Linft	$1,214,026
Storm Water Col.Sys.Grav.	10,600	Linft	$130,000
Storm Watr Coll.Sys.Gravi	18,400	Linft	$820,740
Upper Pump House	3,000	Gpm	$20,102
Var.Elec.Dist.Transformer	4,700	kVA	$3,000
Var.Elec.Pwr.Transformers	2,300	kVA	$61,625
Var.Elec.Pwr Transformers	3,340	kVA	$12,001
Var.Low Volt.Dist.Lines	1.5	Linmi	$112,254
Water Sys.&Othr Watr.Line	2,700	Linft	$256,159
Water Sys.Potable Dist.	12,520	Linft	
Water System Potable Dstr	2,800	Linft	
Watr Sys.,Othr Watr.Lines	5,000	Linft	$509,476
Watr.Sys.Potable Distribu	18,000	Linft	$1,440,478
Total, Distribution Systems			**$13,222,777**

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Table 3-27. Functional Unit 37, Distribution Systems, Life Cycle Chart.

Event Problem/Need	Deficiencies	Existing Requirements	Project Title	Legislative Need*	Funding Type	TEC $M
East Canyon site utilities and sewer monitoring facilities cannot meet safety and environmental standards	East Canyon utilities center and central cooling system and sanitary sewerage and monitoring facilities are aged, obsolete and unreliable	New utilities center and environmental monitoring facilities. Sanitary sewer improvements.	Upgrade Site Mechanical Utilities Phase II – Sewer Monitoring	1,2,3,4,5	Line Item Proposed (MEL-FS/ KG-02)	8.4 FY96
Video survey of oldest portion of underground sanitary sewers revealed sections in imminent danger of failure or leakage.	Long sections of 50 year old sewer system are deteriorated due to corrosion, abrasion and earth movement.	Replacement of 3,480 linear feet of sanitary sewer system.	Sanitary Sewer Restoration	1,2,3,5	Line Item Proposed (MEL-FS/ KG-01)	2.4 FY96
Impending retirement of aged unsafe Big C switching station and imminent failure of aged, unreliable 12 kV distribution cables	50 year old 12 kV substation is unreliable, underrated, and unsafe to operate. 40 year old 12 kV cables are unreliable. Excessive maintenance.	New 12 kV switching station and 12 kV primary and distribution circuits. New step down substations and distribution	Electrical System Upgrade, Phase IV, Blackberry Canyon Switching Station	1,2,3,5	Line Item Proposed (MEL-FS/ KG-02)	7.4 FY98
Phased replacement and upgrading of site mechanical utilities systems to meet safety and programmatic needs	Aged, unsafe and unreliable site mechanical systems unable to meet new EH&S standards.	Replacement and rehabilitation of unreliable portions of water, air, sanitary sewers, acid waste and storm drain sewers	Mechanical Utilities Upgrade, Phase II	1,2,3,4,5	Line Item Proposed (MEL-FS/ KG-03)	9.5 FY03

*Project Categories.

1. Correction of deficiencies in structural, mechanical, electrical and other support and infrastructure systems to ensure safety and health of employees, visitors and the general public in compliance with environmental regulations.
2. Repair and rehabilitation of support facilities, including equipment and infrastructure to assure continued cost effective use, prevent deterioration and protect the national investment.
3. Modification or addition to existing support facilities to ensure their capacity and technological capability to meet the needs of new or expanded programs.
4. Modification or addition to existing support facilities to incorporate and consolidate operations that are uneconomically separated, dispersed or housed in obsolete, deteriorated or temporary buildings.
5. Replacement and removal of old, deteriorated and outmoded support facilities which can no longer be economically upgraded, maintained, and operated.

Table 3-28. Assets List, Other Structures and Facilities (OSF), Functional Unit 38 (Accelerators).

Prop. Name	Size/Capacity	Original Cost
88" Cyclotron	60 MeV	$7,150,951
Advd Light Source (FY93 Completion)	1.5 GeV	$70,000,000
Bevalac	2.1 GeV	$3,959,702
Bevatron	6 GeV	$27,483,261
Heavy Ion Linear Accelerator	8.5 GeV	$13,149,421
Multiple Beam Transport Accel	1 MeV	
Single Beam Transport Accel	160 KeV	$598,958
Van De Graff	15 MeV	$239,201
Van De Graff	2 MeV	$132,347
	Total, Accelerators	**$122,713,841**
	Grand Total, Berkeley Lab Other Structures and Facilities	**$161,281,068**

Table 3-29. Functional Unit 38 Life Cycle Chart (Accelerators).

Event Problem/Need	Deficiencies	Existing Requirements	Project Title	Legislative Need*	Funding Type	TEC $M
Final Shutdown of Bevalac Accelerators in Buildings 51/51A,B, and 71.	Decommissioning requirements.	Stand down and secure transition and D&D	Facilities Decommissioning Plan	1,2,3	DOE Planning Decision	24.6 FY93-01
National Energy Strategy for inertial fusion demonstration power plant.	Lack of test facility to test heavy-ion induction accelerator “driver” for inertial fusion energy.	New 5 meV heavy ion linear accelerator 40 m long with ancillary equipment and modifications to existing facilities (6,400 GSF)	Elise	2,3,4	Line Item (AT) proposed	20.2 FY96

*Project Categories.

1. Correction of deficiencies in structural, mechanical, electrical and other support and infrastructure systems to ensure safety and health of employees, visitors and the general public in compliance with environmental regulations.
2. Repair and rehabilitation of support facilities, including equipment and infrastructure to assure continued cost effective use, prevent deterioration and protect the national investment.
3. Modification or addition to existing support facilities to ensure their capacity and technological capability to meet the needs of new or expanded programs.
4. Modification or addition to existing support facilities to incorporate and consolidate operations that are uneconomically separated, dispersed or housed in obsolete, deteriorated or temporary buildings.
5. Replacement and removal of old, deteriorated and outmoded support facilities which can no longer be economically upgraded, maintained, and operated.

Functional Unit 51 — Medical Equipment

This functional unit is composed of 72 asset items with a total original cost of $676,550. It includes 2 items used for medical research that have an original cost of more than $100,000. These items are listed in Table 3-30. Asset items in this functional unit are used for support functions necessary for Berkeley Lab to operate its Medical Services Facility in Building 26 and in related research activities in other locations within Berkeley Lab and on the UC Berkeley Campus. This equipment includes such items as electrocardiograph machines, gurneys, sterilizers, X-ray machines, audio testing equipment, coulter counter, sorter-call facilities and a myriad of other medical equipment that provides routine industrial medical services or multi-medical emergency services when self-help may be necessary to deal with a radioactive spill or an injurious earthquake.

The condition of most of this equipment is adequate with various degrees of maintenance required. The need for replacement or upgrading is primarily driven by technological obsolescence or operational inefficiency. The life cycle chart for this functional unit is still being developed and will appear in a future edition of the CFP.

Functional Unit 52 — Laboratory Equipment

This functional unit is composed of 5,961 asset items with a total original cost of approximately $133,250,000. It includes 154 items with an original cost of $100,000 or more for which the cost varies up to $3,200,000. There are 13 items which cost over $1,000,000. The most costly assets include major detectors, spectrometers and calorimeters, major electron microscopes such as the Atomic Resolution Microscope, and a myriad of scientific devices used to support the multiprogram missions of the Laboratory. Table 3-31 lists assets for which the original cost exceeds $100,000.

This functional unit provides the primary basis for Berkeley Lab's research and development activities in its laboratories and accelerators. The need for, condition of, and useful life of these assets are driven by the research objectives. The life cycle chart for this functional unit is still being developed and will appear in a future edition of the CFP.

Table 3-30. Assets List, Equipment, Functional Unit 51 (Hospital and Medical Equipment.

Bldg.	Name	Original Cost	Yr. Acq.
010	Sorter-Cell Facs 80	$178,026	80
070A	Sorter-Cell	$108,015	92
	Total, Hospital & Medical Eqpt	**$286,041**	

Table 3-31. Assets List, Equipment, Functional Unit 52 (Laboratory Equipment).

Bldg	Name	Original Cost	Yr Acq
001	Scanner	108,333	65
001	Microscope-Electron	170,282	73
002	Goniometer	110,932	84
002	Profiler-Optical	120,094	91
002	Diffraction Unit	136,197	89
002	Microscope-Scanning Elec	242,715	88
002	Implanter-Ion	244,449	88
002	Sputter System	260,952	89
002	Magnet Tesla Split Pair	273,661	92
002	Surface Analysis System	343,277	89
002	MOCVD System	493,187	89
002	Epitaxy System	1178974	89
002	Monochromator-Vacuum Uv	1,794,413	88
003	Laser-Yag System	140,200	88
003	Laser-Yag System	142,061	84
008	Microscope-Electron	173,922	86
008	Microscope-Electron	199,300	79
008	Stand-Hydraulic Bit Test	250,000	87
010	Data Acquisition System	304,737	90
011	Converter-Ad	217,789	87
011	Spectrometer-NMR	394,668	89
011	Spectrometer-NMR	566,908	87
011	Spectrometer	706,910	90
016	Controller System	110,539	90
016	Source-Surface Convers	232,624	92
016	Pump-Cryogenic	291,332	90
016	Pump-Cryogenic	291,332	90
016	Accelerator-Esq	11,24,783	88
019	Spectrometer	117,785	84
019	System-Sputter	220,552	89
019A	Laser	121,125	87

Table 3-31. Assets List, Equipment, Functional Unit 52 (Laboratory Equipment).

Bldg	Name	Original Cost	Yr Acq
021	Laser-Yag	112,962	86
021	Laser-Sm Dye	576,439	88
022	Spectrometer-NMR	341,754	89
025	Chamber-Sputtering	105,275	87
042	Electron Beam Sys	120,000	70
042	Powered Bin	142,498	84
042	Microscope-Electron	320,482	69
042	Furnace-Drop Calorimeter	379,891	84
046	Microscope-Electron	108,274	92
046	Processor-Signal Digital	120,695	92
046	Purifier-Dri Train	174,859	85
051	Magnet-Quadrupole	100,195	87
051	Magnet-Quadrupole	100,196	87
051	Magnet-Quadrupole	100,196	87
051	Isolator-Box	145,229	83
051	Detector-Scintillation	149,829	87
051	Detector-Phase	150,176	91
051	Switching Unit	162,312	79
051	Chamber-Time Projection	169,560	89
051	Magnet	173,366	67
051	Monitor-Beam Profile	199,336	92
051	None	199,969	91
051	Positioner-Patient	244,433	78
051	Magnet	286,022	64
051	Detector-Scintillation	315,908	90
051	Controller-Valve	323,620	91
051	Laser-Yag	329,359	90
051	Control-Power Supply	413,814	85
051	Magnet-Pulsed Switching	434,852	89
051	Chamber-Drift	437,733	87
051	Chamber-Drift	1,204,908	87
051	Spectrometer-Hi Intensty	2,228,255	80

Table 3-31. Assets List, Equipment, Functional Unit 52 (Laboratory Equipment).

Bldg	Name	Original Cost	Yr Acq
051	Chamber-Time Proj-Hiss	3,203,610	92
051A	Magnet-C	169,665	85
051A	Magnet-C	169,665	85
052	Bench-Linear Draw	105,226	85
052	Tester-Cable	593,980	92
058	Pulser-Thyratron	156,107	88
058	Data Acquisition Sys	158,974	81
058	Beam Steering Inst-Multi	204,185	85
058	Beam-Low Energy	387,283	88
058	Amplifier-Hv Trigger	747,785	88
058A	Monitor-Beam Diagnostics	315,040	91
062	Cell-Hi Pressure	104,591	92
062	Microscope-Electron	127,443	82
062	Tester	128,174	67
062	Detector-Gas	163,670	89
062	Furnace-Hot Press	226,508	89
066	Spectrometer	115,000	90
066	Microscope-Tunneling	115,488	90
066	Laser-Yag	118,252	89
066	Pumping System-Leeds	177,363	87
066	Control-Auger System	195,975	79
066	Reactor-Catalytic	197,490	88
066	Magnet-Super Conducting	200,700	88
066	Spectrometer-NMR	232,116	88
066	System-Surface Analysis	248,164	88
066	System-Surface Analysis	512,228	88
070	Generator-Particle	100,702	82
070	Detector, Ultraviolet	145,280	88
070	Chamber-Environmental	147,385	88
070A	Spectrometer-System	105,119	79
070A	Magnetic Measuring Sys	121,290	88
070A	Reactor-Glow Discharge	165,172	89

Table 3-31. Assets List, Equipment, Functional Unit 52 (Laboratory Equipment).

Bldg	Name	Original Cost	Yr Acq
070A	Spectrometer	246,400	89
070A	Furnace System	457,059	90
070A	Furnace System	457,059	90
071	Analyzer-Network	108,019	91
071	Injector-Adam	179,734	92
071	Power Supply-Rf System	349,850	91
072	Analyzer-Micro	103,912	84
072	Microscope-Electron	169,883	83
072	Microscope-Electron	302,524	80
072	Accelerator	320,000	80
072	Generator	480,000	80
072	Microscope-Electron	841,303	80
072	Microscope-Atomic Resolu	3,101,719	83
073	Spectrometer-Photoelect	104,480	80
073	Analyzer-Gas	176,801	83
074	Cabinets-Casework	102,054	90
074	Source-Irradiation	115,264	84
080	Furnace-Horizontal	128,325	80
088	Detector-Array	146,265	90
088	Detector-Nai	186,383	88
088	Microwave System	193,601	85
088	Control-Ionizer	195,836	85
088	Holder	201,080	84
088	Control-Ionizer	249,170	85
088	Chamber-Scattering	423,344	65
088	Control-Ionizer	575518	85
088	Detector-System	1,209,318	87
090	Berkeley Lab Fabs	100,401	88
090	Unidentified Berkeley Lab Fabs	107,588	87
090	Berkeley Lab Fabs	336,011	88
090	Berkeley Lab Fabs	467,984	88

Table 3-31. Assets List, Equipment, Functional Unit 52 (Laboratory Equipment).

Bldg	Name	Original Cost	Yr Acq
901	Spectrometer-Low Energy	125,442	80
901	Radio-Base	153,034	67
901	Radio-Base	153,034	67
901	Generator-Plasma	197,430	90
901	Power Supply	313,434	80
901A	Generator-Cryo	139,389	85
905	Laser-Shock Tube	244,784	91
936	Berkeley Lab Fabs	271,689	89
936	Berkeley Lab Fabs FY91	420,396	91
936	Berkeley Lab-Constr-FY92	445,769	92
936	Berkeley LabFabs FY92	851,057	92
936	Berkeley Lab-Constr-FY89	1,633,194	89
936	Berkeley Lab-Constr-FY91	1,903,562	91
9485	Profiler-Optical	112,094	91
950	Stage-Translation	138,729	88
950	Drive-Wiggler Magnet	330,251	85
950	Detector-Vertex	450,075	88
983	Simulator-Sky Liminance	158,036	92
9C87	Calorimeter-Hadron	1,253,585	88
9C88	Chamber-Refocusing	108,573	89
9C90	Detector-D0 Vertex	1,066,888	88
9C90	Calorimeter Electrmagnet	2,924,141	91
9C92	Chamber-Time Projection	724,440	87
9C92	Chamber-Drift Jet	820,433	88
9L85	Accelerator-Rfq	225,103	87
B31A	Processor-Seismic	366,400	88
B67C	Analyzer-Gas	103,344	86
	Total, Laboratory Equipment	**?**	

Functional Unit 53 — Motor Vehicles

This functional unit is composed of 203 government-owned items with an original cost of $43,306,692. It includes 5 asset items with an original cost of $100,000 or more. Three of these are buses, one is a fire truck and one is a highly sophisticated energy research trailer, "MOWITT," which is used for experimental purposes at remote geographic locations off-site. These 5 asset items are listed in Table 3-32.

All automobiles used by Berkeley Lab are leased vehicles and therefore are not included in the 203 asset items included in this functional unit.

Government-owned motor vehicles at the Laboratory are well maintained. However, continuous use on the steep, winding roads of the Berkeley Lab site is much more wearing than travel on flat sites or public roadways. Consequently, vehicles must be replaced as funding permits to provide safe, efficient travel. The life cycle chart for this functional unit is still being developed and will appear in a future edition of the CFP.

Functional Unit 54 — Office Furniture and Equipment

This functional unit is composed of 369 asset items with a total original cost of $1,201,071. There are no individual items with an original cost over $100,000.

Table 3-32. Assets List, Equipment (>$100 K), Functional Unit 53 (Motor Vehicles and Aircraft).

Bldg	Name	Original Cost	Yr Acq
076	Bus	105,890	80
076	Bus	115,590	89
076	Truck-Fire	117,334	90
076	Bus	124,821	90
9C86	Trailer-MOWITT	791,874	81
	Total, Motor Vehicles and Aircraft	**1,255,459**	

This equipment typically includes typewriters, calculators, personal computers, copiers, projectors, printers, plotters, facsimiles, desks, credenzas, file cabinets, and open space movable partition type furniture.

The condition of this equipment varies greatly with age and level of technology. The life cycle chart for this functional unit is still being developed and will appear in a future edition of the CFP.

Functional Unit 58 — Security and Protection Equipment

This functional unit is composed of 45 asset items with a total original cost of $437,272. Since Berkeley Lab is a non-nuclear facility and does no classified work on-site, Security and Protection activities are primarily related to controlled access for public health and safety, property protection, vehicular and pedestrian safety, emergency activities and communications, and the support of other emergency response departments. Asset items in this functional unit are used to support these activities. None has an original cost greater than $100,000.

The condition of this equipment is adequate, with various degrees of maintenance required. The need for replacement or upgrading is primarily driven by age, technological obsolescence or operational inefficiency. The life cycle chart for this functional unit is still being developed and will appear in a future edition of the CFP.

Functional Unit 59 — Shop Equipment

This functional unit consists of equipment used in building craft and maintenance shops, machine shops, electronic shops, and mechanical technology and fabrication shops. Asset items number 344, with a total original cost of $7,628,000. The unit includes 11 items with an original cost of over $100,000. They are primarily sophisticated machine tools used for R&D fabrications of state-of-the-art particle detectors, accelerator components and experimental apparatus. These asset items are listed in Table 3-33.

The condition of asset items in this functional unit varies from poor to excellent, depending on age, technological requirements or obsolescence and the intensity of maintenance applied. The shops that utilize these asset items support the R&D missions of the Laboratory. In turn, programmatic needs drive the need for upgrading or replacing these assets. The life cycle chart for this functional unit is still being developed and will appear in a future edition of the CFP.

Table 3-33. Assets List, Equipment (>$100K), Functional Unit 59 (Shop Equipment)

Bldg	Name	Original Cost	Yr Acq
052	Forming Machine	180,000	84
077	Cutting Machine-RAM Edm	119,000	92
077	Milling Machine	136,000	68
077	Cutter	145,000	84
077	Machining Center Vrt Mil	158,000	92
077	Machining Center Vrt Mil	162,000	92
077	Cutting Machine-Wire Edm	180,000	87
077	Boring Machine	189,000	81
077	Coordinate Measuring Mch	240,000	90
077	Boring Machine	427,000	81
9C88	Cabling Machine	300,000	89
	Total Shop Eqpt	**2,237,000**	

Functional Unit 60 — Automatic Data Processing Equipment

This functional unit is composed of Automatic Data Processing (ADP) Equipment used by all divisions of the Laboratory. Asset items include mainframe computers, server networks, workstations and personal computers, which are also listed under FU54. They number 7,867 and have a total original cost of $40,279,560. There are 36 items with an individual original cost greater than $100,000. Table 3-34 lists these asset items.

ADP equipment is inherently valuable to the success and efficiency of Berkeley Lab's programmatic missions, including related engineering, environmental health and safety, shop and administrative support functions. The condition, technological state and useful life of these assets are driven by Berkeley Lab's R&D missions and the need for efficiency.

Portions of these assets need to be upgraded or replaced due to age or technological obsolescence. Some additional redundancy is needed to ensure the continuity and reliability of Berkeley Lab programs. The life cycle chart for this functional unit is still being developed and will appear in a future edition of the CFP.

Table 3-34. Assets List, Equipment (>$100 K), Functional Unit 60 (Automatic Data Processing Equipment).

Bldg	Name	Original Cost	Yr Acq
042	Computer	103,620	84
042	Computer	134,307	72
046	Computer	112,694	78
050	Computer	113,551	82
050B	Control-Disk Drive	111,643	92
050B	Disk Drive Array	119,446	91
050B	Workstation	121,828	92
050B	Computer-Workstation	133,218	88
050B	Computer-Workstation	155,353	90
050B	Workstation	180,139	91
050B	Computer-Workstation	188,640	86
050B	Computer-Imaging	207,210	90
050B	Workstation	230,114	91
050B	Workstation	230,114	91
050B	Server-Network	269,204	91
050F	Computer-Workstation	115,553	88
051	Computer	175,505	84
051	Computer	260,776	81
055	Computer	236,919	84
058	Computer	143,044	80

Table 3-34. Assets List, Equipment (>$100 K), Functional Unit 60 (Automatic Data Processing Equipment).

Bldg	Name	Original Cost	Yr Acq
071	Computer	139,702	78
071	Computer	251,466	75
080	Workstation-U H Vacuum	146,162	92
090	Server-Network	284,726	88
901	Computer	191,979	81
901	Computer	198,012	78
901	Computer	306,140	84
901A	Computer	103,218	84
901A	Computer	109,562	78
901A	Computer	112,277	78
901A	Computer	126,724	81
901A	Computer	128,625	84
901A	Computer	213,255	84
9C87	Display	99,999	86
B51L	Enclosure-Experimental	148,763	85
B51L	Server-Network	161,274	88
	Total, Automatic Data Processing Equipment	**$6,064,772**	

Functional Unit 79 — Miscellaneous Equipment

This functional unit is composed of 287 asset items with a total original cost of $8,331,462. It includes 14 items with an original cost over $100,000. These are listed in Table 3-35.

Asset items were initially assigned to this functional unit because of their special purpose, short design life or lack of functional classification to other RPIS categories.

The condition of these assets varies considerably, depending on specific use, design life, type and intensity of maintenance and technological obsolescence. The life cycle chart for this functional unit is still being developed and will appear in a future edition of the CFP.

ALTERNATIVES — **D**EVELOPMENT

To evaluate the potential of the site, the Laboratory has commissioned a number of site-use studies (Appendix A) and is currently conducting a landscape master plan for the entire main site. These studies have been used to create an site development plan based on optimal functional relationships. This is represented by the 20-Year Master Plan in Chapter 4. Efficiency of operating and building capital resources to strengthen the Laboratory's ability to carry out the DOE

responsibilities guide the development of the 20-Year Master Plan. The grouping of like functions, renovation, and replacement of obsolete or inadequate research facilities and infrastructure, and the improvement of circulation for people and materials among work areas are cornerstones of the 20-Year Master Building Plan and Landscape Master Plan.

ALTERNATIVES—**E**VALUATION

Restrict Growth

The Laboratory considers the restriction of growth in selected areas to be a normal part of management and operation. As discussed under Planning Process in Chapter 2, the Laboratory carefully reviews proposed research activities to ensure that existing capabilities will support the proposed activities and that they are consistent with the Laboratory mission. This policy has resulted in moderate growth during most of the Laboratory's history, with the exception of retrenchment in the early 1980s. As the site becomes more developed, new work is closely scrutinized to ensure that it does not unduly burden the Laboratory's performance capabilities.

Satellite Locations

Off-site, or satellite, facilities for support functions and research programs are used when decentralized locations are appropriate. The warehousing and receiving support functions were moved in 1980 to the cities of Emeryville and Berkeley. Moving these functions to industrial areas near major freeways eliminated much of the Berkeley Lab heavy-truck traffic that had added to the traffic congestion of Berkeley streets. In addition, Berkeley Lab's Printing Plant was relocated to 2,200 gsm (24,000 gsf) of space in an industrial park in West Berkeley in 1979 as a near-term solution to a space shortage. The Laboratory has leased 1,100 gsm (11,500 gsf) of office space in downtown Berkeley to house administrative functions beginning in the winter of 1989. Additional relocations and leasing of administrative office space also took place in FY 1993, including relocation of Human Resources to the Promenade Building 938 in downtown Berkeley.

Berkeley Lab research programs also use off-site locations. For example, there are facilities at UCB's Richmond Field Station (RFS) for the Earth Science Division's research and for the Energy and Environment Division's indoor environment program. The indoor-environment program maintains at the RFS a research building known as the Radon Research House, a unique experimental facility used for the national radon research program and other indoor air quality research. The Engineering Division monitors particle decay in a low-cosmic-radiation-background environment at the Oroville Dam powerhouse. In addition, other research programs

are located in short-term leased buildings when temporary space is required or when cost effective facilities are not available at the main site.

Berkeley Lab will continue to evaluate its needs for support services and for research facilities with respect to their appropriateness to the main site. Those needs that are characterized as being well suited to decentralization will be placed off-site when suitable space is available.

Intensify Use

To maximize the use of each building site, building massing has become increasingly important. Although low-rise development is less expensive, the land constraints that face Berkeley Lab require that either multistory buildings be constructed (including possible multistory parking structures) or that single-story buildings be constructed so as to allow addition of upper stories. However, design guidelines include some limitations. For instance, one guideline states, "Buildings are to be designed to fit well into the slope of the land, to conserve important landscape features and open space, and to be closely integrated with the landscape plan. They are to be no more than five stories and may not present an uninterrupted wall greater than four stories high."

In addition, the plan calls for removal of most of the temporary structures built in the 1940s and all of the trailers. This will provide many of the building sites identified in the 10- and 20-year plans. Details of this reuse are in Chapters 4 and 5.

Expand the Site

Expanding the existing site to accommodate new development requirements is attractive in several ways. The use of functional-area groupings provides Laboratory planners with the ability to expand building sites and improve traffic circulation and communication facilities. Infrastructure expansion to adjacent lands is also less costly and less difficult than establishing new infrastructure at new sites such as satellite locations. The Laboratory negotiates expansion of the boundaries of the site with the UC Regents as the need arises. New facilities are budgeted and proposed for this area as noted in the 10- and 20-Year Plans.

Additional expansion is to be accommodated in close coordination with UCB for undeveloped land within the 478 hectares (1,100 acres) owned by the Regents, by the current ceiling of 4,750 personnel, and by environmental considerations.

ACCOMMODATION FOR **C**HANGES IN **D**IRECTION

The planning concepts and design guidelines presented in this plan result in a functional-area arrangement that ensures that planning practices are exercised while allowing flexibility of use. Improvements to infrastructure (mechanical and electrical utilities, communications, traffic circulation, and support services) allow for multiple uses over the long term. This arrangement and the appropriate use of satellite and temporary space form the basis for accommodating changes in direction. Berkeley Lab has responded quickly and efficiently to changes in national research directions in the past and will continue to do so in the future, if necessary.

Design guidelines and concepts include specialized research facility zones in proximity to major research facilities.

Berkeley Lab does not rely solely on any one of the broadly based alternatives described above. Rather, its response to decisions on development and redevelopment involves the judicious use of an appropriate mix of alternatives. Satellite locations are used for certain support functions because they need not be close to scientific, technical, and research staff. Consolidation of other support services, such as Environmental Health and Safety, Materiel Management, and maintenance and repair units on the main site makes immediately available the skilled personnel required to support and safeguard research programs.

4. TWENTY-YEAR MASTER PLAN

FUTURE LAND USE

If all projects identified in the 20-Year Building Master Plan are completed, the proportion of developed land would change from the current 38% to 42%, and the existing 32 hectares (80 acres) of open space would reduce to 31 hectares (78 acres) (Figure 4-1).

Although plans call for the volume of building to increase, future building footprints will be more compact and designed in accordance with landscape plans. Therefore, although the total amount of open space will decrease, the sizes of landscape areas between buildings will increase, making the Laboratory more attractive to the research community and the community at large.

If the full programmatic capability of the Berkeley Lab main site is developed with the sites and buildings identified in this Master Plan, the result would be an increase of 40,000 gsm (0.4 Mgsf) to a total of approximately 190,000 gsm (2.0 Mgsf). For comparison, the 1993 total, including current construction, consists of 150,000 gsm (1.62 Mgsf) at the main site.

The Laboratory's main site space is now 100% utilized with approximately 70% net efficiency. Usable space is approximately 102,190 net square meters (1.1 M net square-feet). The building utilization efficiency is not projected to change significantly, although the efficiency of land use is expected to improve by replacing obsolete single- and two-story buildings with three- to five-story structures.

20-YEAR CONSTRUCTION PLAN

The 20-Year Building Plan (Figure 4-2) specifies the Laboratory's prioritized use of its capital funds to replace obsolete facilities and the actions needed to protect these investments in the future. The plan calls for correction of current deficiencies as quickly as economically feasible and calls for a structured system of maintenance of the site and its capital assets throughout their normal service lives. Correction of current deficiencies, e.g., utilities and building rehabilitation, building replacements, road rehabilitation, and slope stabilization, will continue through FY 2010.

Laboratory management has developed the plan with due regard to budgetary constraints. Funding below the projected levels will create an increasing backlog of rehabilitation projects, creating a situation that will be difficult to correct.

The 20-Year Plan provides programmatic facilities identified through planning analyses. The Advanced Light Source (ALS) received initial funding in FY 1987 and was completed in FY 1993. This project is the first phase of a long-term plan to develop a national research facility. Beyond the construction of the ALS itself, construction of additional beamlines and experimental areas and additional support facilities for users is anticipated. To accomplish this, the ALS Structural Biology Support Facility has been funded for FY 1995 and the ALS Beamline Initiative is proposed for FY 1996. The Chemical Dynamics Research Laboratory is also proposed for a FY 1996 construction start. The recently funded Human Genome Laboratory, and facilities for inertial confinement fusion (Elise) and Magnetic Confinement Fusion (Accelerator Test Facility for ITER) are important elements of the master plan and contribute to DOE's research capabilities.

Total Berkeley Lab construction for FY 1996–2015, including funded construction, budgeted construction, and proposed construction, is shown in Table 4-1, and proposed building placement is shown in the site map, Figure 4-2.

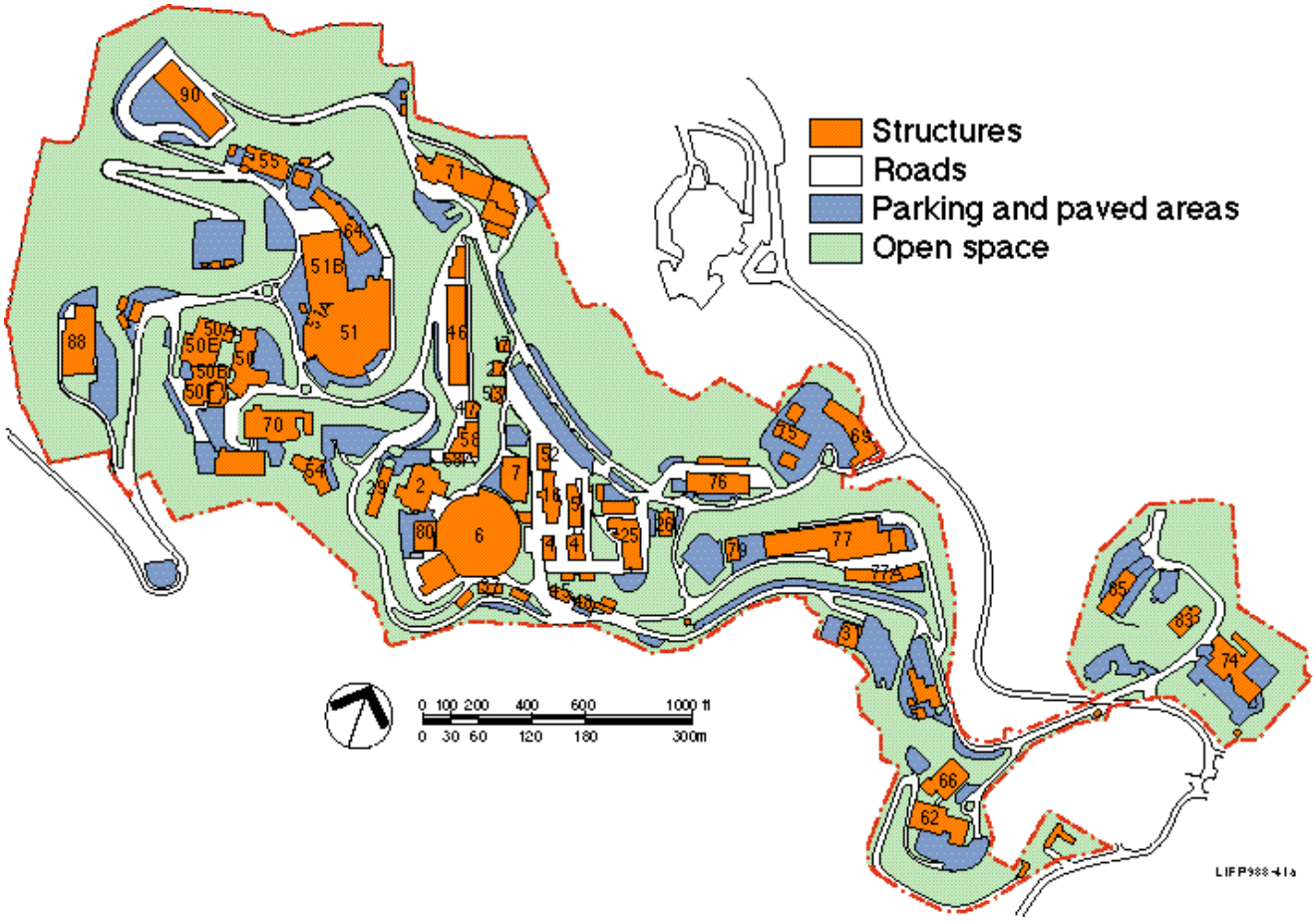


Fig. 4-1. Future land use.

Table 4-1. Twenty Year MEL-FS Project Plan – Unconstrained Funding Scenario (1996-2015).

FY	Project	CAMP Rating	Goals[a] 1	2	3	4	5	Functional Unit Code	Subprog	TEC	Prior*	$M 1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
FUNDED MEL-FS PROJECTS:																																	
88	Environmental, Health & Safety									13.163	**11.492**	1.691																					
92	East Canyon Electrical Safety Project									3.900	**1.332**	1.568	1.000																				
93	Fire & Safety Systems Upgrade Proj, Ph 1								TTR	4.600	**0.500**	1.000	2.000	1.100																		
	Hazardous Materials Safeguards, Ph 1								TTR	4.720	**0.500**	0.970	1.962	1.288																		
	SUBTOTAL - FUNDED MEL-FS PROJECTS									26.383	**13.804**	5.229	4.962	2.388																		
BUDGETED MEL-FS PROJECTS (KG)																																	
94/95	No new project starts in FYs 1994 or 1995																																
	SUBTOTAL - BUDGETED MEL-FS PROJ									**0.000**	**0.000**	**0.000**	**0.000**	**0.000**																		
TOTAL FUNDED AND BUDGETED										**26.383**	**13.804**	**5.229**	**4.962**	**2.388**																		
PROPOSED MEL-FS PROJECTS:																																	
96	Safety & Support Services Facility	67.1	•		•	•	•	10-Adm Blds	ES&H	12.8				1.4	0.8	10.0	0.6																
	Upgrd of Site Mech Util, Ph II - Sewer Monit	65.2	•	•	•	•	•	37-Distrb Sys	ES&H	8.4				1.0	3.6	3.7	0.1																
	Sanitary Sewer Restoration	65.2	•	•	•		•	37-Distrb Sys	GPF-Other	2.4				0.4	1.6	0.4																	
	Mechanical Equipment Upgrade, Ph I	63.4	•	•	•		•	15-R&D Blds	GPF-Other	4.5				0.5	3.8	0.1	0.1																
97	Envir Monitoring & Industrial Hygiene Bldg	66.8	•		•	•	•	10-Adm Blds	ES&H	24.9					4.0	9.0	7.0	4.9															
	Roadway Safety & Stabilization, Phase I	64.5	•	•		•	•	30-Transp sys	ES&H	7.0					1.0	3.0	2.0	1.0														
	LBNL Commu. Conduit Infrastructure Impvmts	63.4	•	•	•		•	36-Com/Secur	GPF-Other	3.8					0.6	2.0	1.0	0.2														
	Upgrade of LBNL Radio Comm. System	63.4	•	•	•		•	36-Com/Secur	ES&H	4.7					0.7	2.3	1.0	0.7														
	Facilities Building	63.8	•		•	•	•	10-Adm Blds	GPF-Bldg	16.5					2.5	6.0	4.5	3.5														
98	Medical Serv Asbestos Abatement & Rehab	58.0	•	•	•	•		10-Adm Blds	ES&H	3.2						0.3	2.1	0.8														
	Roof Replacements, Ph II	64.5	•	•			•	15-R&D Blds	GPF-Other	7.5						0.7	3.8	3.0														
	Elec Sys Rehab, Ph IV - BBC Swch Sta Replc	63.3	•	•	•	•	•	37-Distrb Sys	ES&H	7.4						0.7	3.6	3.1														
	"Old Town" Parking Structure	59.0	•	•		•	•	30-Transp Sys	GPF-Bldg	3.0						0.3	1.6	1.1														
99	Blackberry Canyon Parking Structure	59.0	•	•		•	•	30-Transp Sys	GPF-Bldg	23.0							3.5	7.0	7.0	5.5												
	Admin Services Addn - Bldg 50E/F 2nd Fl	57.1		•		•	•	10-Adm Blds	GPF-Bldg	9.4							1.4	3.0	3.0	2.0												
	Fire & Safety Systems Upgrd Project, Ph II	64.5	•	•	•			15-R&D Blds	ES&H	5.7							0.9	2.4	2.4													
	Hazardous Materials Safeguards, Phase II	60.0	•	•	•			15-R&D Blds	ES&H	8.1							1.2	3.5	3.4													
00	Research Incubator Facility	60.0			•	•	•	15-R&D Blds	GPF-Bldg	17.8								1.8	6.0	6.0	4.0											
	Technology Transfer Buildings	60.0			•	•		10-Adm Blds	GPF-Bldg	11.9								1.2	5.0	3.0	2.7											
	Maintenance Bldg Replacement, Ph I-Bldg 76	60.0	•	•	•			14-Svc Blds	GPF-Bldg	6.5								0.6	3.1	2.8												
01	Building Sys. Upgrade, Ph I - Bldg 90,50,50B	55.0	•	•	•		•	15-R&D Blds	ES&H	12.0									1.5	4.5	4.0	2.0										
	Roadway Safety & Stabilization, Phase II	64.5	•	•	•		•	30-Transp Sys	ES&H	7.7									1.0	3.7	3.0											
	Fire and Safety Systems Upgrade, Phase III	64.5	•	•	•		•	15-R&D Blds	ES&H	5.8									0.8	2.5	2.5											
02	Bldg. 50 Auditorium Expansion	63.3	•	•	•	•		10-Adm Blds	GPF-Bldg	8.8										0.9	3.5	3.3	1.1									
	Mechanical Equipment Upgrade, Phase II	63.3	•	•	•		•	15-R&D Blds	GPF-Other	5.4										0.5	2.8	2.1										
	Roof Replacements, Ph III	64.5	•	•			•	14-Svc Blds	GPF-Other	9.0										0.9	3.7	3.4	1.0									

Table 4-1. Twenty Year MEL-FS Project Plan – Unconstrained Funding Scenario (1996-2015).

FY	Project	CAMP Rating	Goals[a] 1	2	3	4	5	Functional Unit Code	Subprog	TEC	Prior*	$M 1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
03	Mechanical Utilities Upgrade, Phase II	57.6	•	•	•	•	•	37-Distrb Sys	ES&H	9.5											0.9	4.9	3.7										
	Maint Build Replacement, Ph II-Bldg 78	60.0	•	•	•	•		10-Adm Blds	GPF-Bldg	5.4											0.6	2.8	2										
	Day Care Facility	55.0				•		10-Adm Blds	GPF-Bldg	5.8											0.6	3.0	2.2										
	Seismic Safety Improvement Project	64.5	•	•				15-R&D Blds	ES&H	5.4											0.5	2.8	2.1										
04	Applied Sciences Building	60.0	•		•	•	•	15-R&D Blds	GPF-Bldg	26.8												4.0	13.9	8.9										
05	Roadway Safety & Stabilization, Phase III	64.5	•	•		•	•	30-Transp Sys	ES&H	9.7													0.9	5.0	3.8								
	Science Education and Visitor Center	60.0			•	•		10-Adm Blds	GPF-Bldg	11.1													1.1	6.4	3.6								
	Build Sys Upgrade, Ph II - Bldgs 64,75,79,88	55.0	•	•	•		•	14-Svc	ES&H	10.9													1.0	5.9	4.0								
06	Site Electrical Equip Replcmt, Ph I	63.3	•	•	•			15-R&D Blds	ES&H	7.4														0.7	3.9	2.8							
	Mech Eng Replcmt Bldg. Ph I	60.0	•		•	•	•	14-Svc Blds	GPF-Bldg	20.8														2.0	10.8	8.0							
07	Mechanical Utilities Upgrade, Phase III	57.6	•	•				37-Distrb Sys	GPF-Other	11.4															1.0	5.9	4.5						
	Roof Replacements, Ph IV	64.5	•	•			•	15-R&D Blds	GPF-Other	15.3															1.5	7.9	5.9						
08	Mechanical Utilities Upgrade, Phase IV	57.6	•	•				37-Distrb Sys	GPF-Other	9.9																0.9	5.3	3.7					
	Integrated Comm. & Computer Facility	55.0			•	•		10-Adm Blds	GPF-Bldg	19.7																2.0	10.2	7.5					
09	Building Sys. Upgrade, Ph III - Bldgs 58 & 77	55.0	•	•	•		•	14-Svc Blds	ES&H	17.0																	1.7	8.8	6.5				
	Fire and Safety Systems Upgrade, Phase IV	64.5	•	•	•			15-R&D Blds	ES&H	10.3																	1.0	5.4	3.9				
	Mech Eng Replcmt Bldg. Ph 2	60.0	•		•	•	•	14-Svc Blds	GPF-Bldg	14.4																	2.0	7.0	3.0	2.4				
10	LBNL's Conference/Publications Facility	55.0		•	•	•		10-Adm Blds	GPF-Bldg	9.5																		0.9	4.9	3.7				
	Administrative Services Facility	55.0			•	•		10-Adm Blds	GPF-Bldg	34.0																		3.2	12.0	12.0	6.8			
11	Mechanical Utilities Upgrade, Phase V	57.6	•	•				37-Distrb Sys	GPF-Other	17.6																			1.7	6.0	6.0	3.9	
	Building Sys. Upg., Ph IV - Bldgs 47,62,70,72	55.0	•	•	•	•		15-R&D Blds	ES&H	18.5																			1.8	6.0	6.0	4.7	
12	Haz. Materials Storage & Dispensing Rms	50.0	•	•	•	•	•	12-Storage	GPF-Bldg	3.4																				0.3	1.7	1.4	
	Strawberry Gate Parking Structure	55.0				•	•	30-Transp Sys	GPF-Bldg	5.7																				0.6	3.0	2.1	
13	Mechanical Equipment Upgrade, Phase VI	57.6	•	•				37-Distrb Sys	GPF-Other	7.1																					0.7	3.7	2.7
	Building Sys. Upg., Ph V - Bldgs 50A,74	55.0		•	•	•		10-Adm Blds	ES&H	21.2																					2.0	11.0	8.2
14	Site Electrical Equip Replcmt, Ph II	55.0	•	•	•			37-Distrb Sys	ES&H	9.7																						0.9	6.2
	Pedestrian Circulation System	55.0			•			30-Transp Sys	ES&H	6.1																						0.6	3.5
15	Bldg. Sys. Upg., Ph VI - Bldgs 50D,50E,55,71	55.0	•	•	•	•		15-R&D Blds	ES&H	20.2																							2.0
	Grizzly Peak Gate Parking Structure	55.0				•	•	30-Transp Sys	GPF-Bldg	10.1																							1.0
	SUBTOTAL - PROPOSED MEL-FS PROJECTS									611.1	0.0	0.0	0.0	3.3	18.6	38.5	34.4	37.8	33.2	32.3	28.8	28.3	29.0	28.9	28.6	27.5	30.6	36.5	33.8	31.0	26.2	28.3	23.6
	TOTAL FUND, BUDGT & PROP MEL-FS PROJ									637.5	13.8	5.2	5.0	5.7	18.6	38.5	34.4	37.8	33.2	32.3	28.8	28.3	29.0	28.9	28.6	27.5	30.6	36.5	33.8	31.0	26.2	28.3	23.6

August 1993 escalation rates at 2.6%, FY'93; 3.4%, FY'94; 4.0%, FY'95; 39%, FY'96; 3.8%, FY'97; 3.6%, FY'98; 3.7%, FY'99; 3.7%, subsequent years.
Includes an 8.61% Overhead Factor (on TEC). Overhead Factor is subject to change.
* = Prior costs from previous Fiscal Years.
[a]Goals are defined as follows:
1. Correction of deficiencies in structural, mechanical, electrical and other support and infrastructure systems to ensure safety and health of employees, visitors and the general public in compliance with environmental regulations.
2. Repair and rehabilitation of support facilities, including equipment and infrastructure to assure continued cost effective use, prevent deterioration and protect the national investment.
3. Modification or addition to existing support facilities to ensure their capacity and technological capacity to meet the needs of new or expanded programs.
4. Modification or addition to existing support facilities to incorporate and consolidate operations that are uneconomically separated, dispersed or housed in obsolete, deteriorated or temporary buildings.
5. Replacement and removal of old, deteriorated and outmoded support facilities which can no longer be economically upgraded, maintained, and operated.

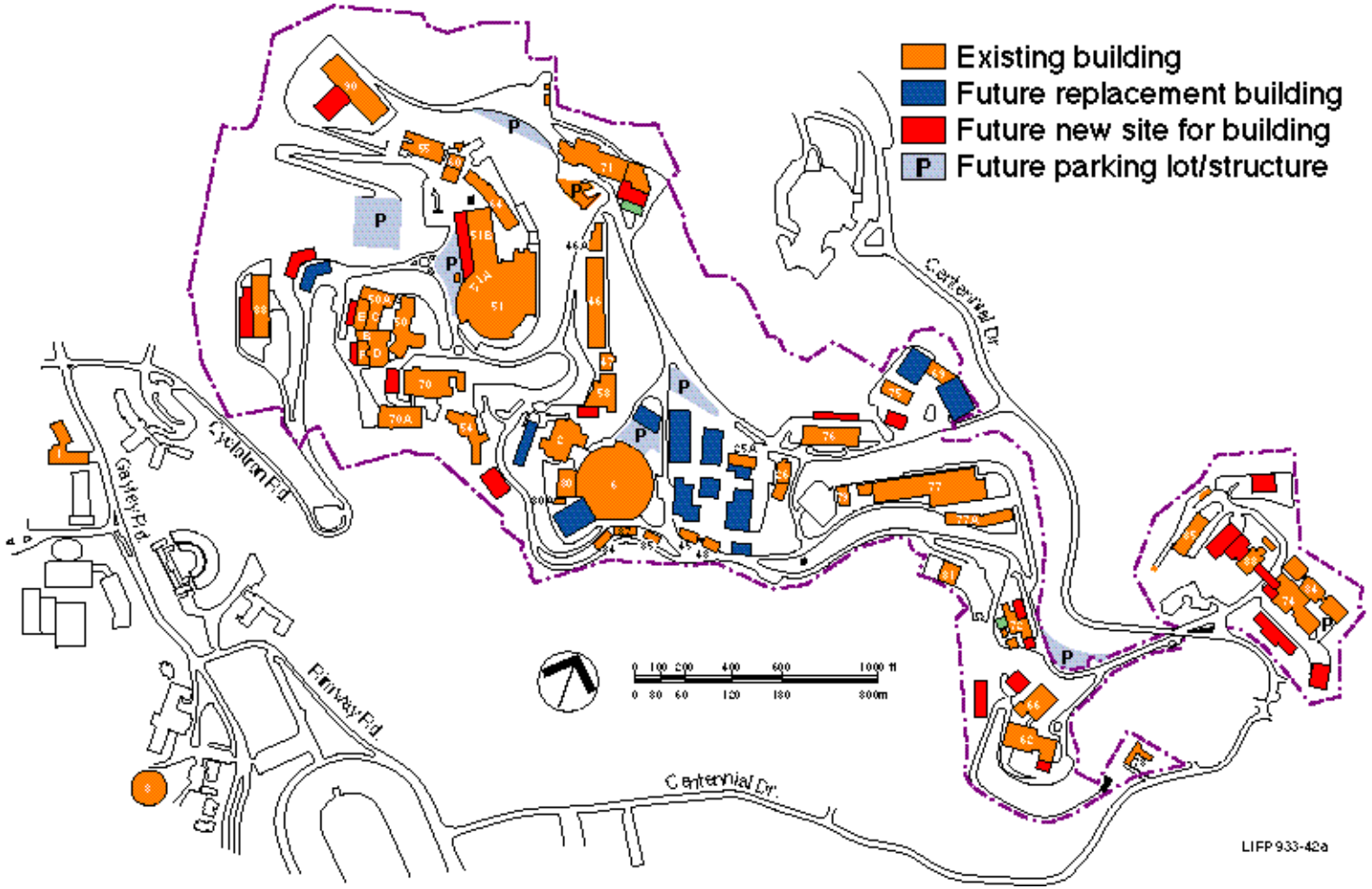


Fig. 4-2. Twenty-year construction plan.

LANDSCAPE PLAN

Berkeley Lab has recently completed the initial phases of a Landscape Plan that provides a comprehensive framework to guide future land use decisions. The Plan includes concepts and recommendations for a variety of site functions including vehicular and pedestrian circulation, parking, outdoor use areas, and vegetation management (Figure 4-3).

Circulation

The site circulation concepts address roadway safety and efficiency as well as pedestrian circulation needs. Recommendations in the Landscape Plan include:

- Development of a two-way primary road system, eliminating existing one-way sections and choke points
- Upgrading the image and appearance of the entrance gates, primarily the Main Gate
- Development of a comprehensive signage system that supports way-finding
- Creation of a central pedestrian spine linking the site's major destinations and population centers
- Completion of important secondary pedestrian linkages and a perimeter walk/trail

Parking

Solutions to Berkeley Lab's parking needs incorporate a multi-pronged approach involving transportation management programs, flexible work hours, changes to the parking permit system, and additional parking capacity. Provision of new parking is necessary to alleviate existing insufficiencies and to allow growth of the Laboratory. However, there is no suitable land available for expansion of surface parking and conditions will worsen if existing lots are displaced by future building development. To provide flexibility in resolving this difficult issue, the Landscape Plan proposes options which can be implemented incrementally.

District Parking. This approach would provide a number of one to three level parking structures dispersed throughout the Laboratory site according to planning area needs. The structures may be freestanding or could occur as lower levels of new buildings. Surface parking would remain where feasible and not in conflict with circulation or building development needs.

Peripheral Parking. This approach develops new parking structures only at or near site entrances. Such locations will reduce through-site trips and traffic congestion, and require increased shuttle service and pedestrian path improvements.

Parking Policies and Transportation Management. Berkeley Lab will continue to monitor and refine parking policies and transportation management programs. The Laboratory encourages and facilitates use of the shuttle and public transit linkages, carpooling, vanpooling, and bicycles.

Outdoor Use Areas

The Landscape Plan emphasizes the value of outdoor use areas which create an image and sense of campus as well as provide amenity for employees and visitors. Outdoor places are an important element of a mature and comprehensive campus, contributing valuable and necessary environmental relief from the workplace. They also can offer alternative space for meetings, gatherings, and lunch in good weather. Specific recommendations include:

- Creation of a central, landscaped pedestrian corridor or spine as the heart of the Laboratory site and linking major site destinations
- Development/improvement of secondary outdoor areas for social and recreational uses in each planning area, with attention to favorable microclimatic conditions
- Provision of quality spaces at major building entrances
- Development/improvement of pedestrian linkages to outdoor use areas

It is expected that implementation of these proposals will occur incrementally in association with site maintenance and adjacent new construction.

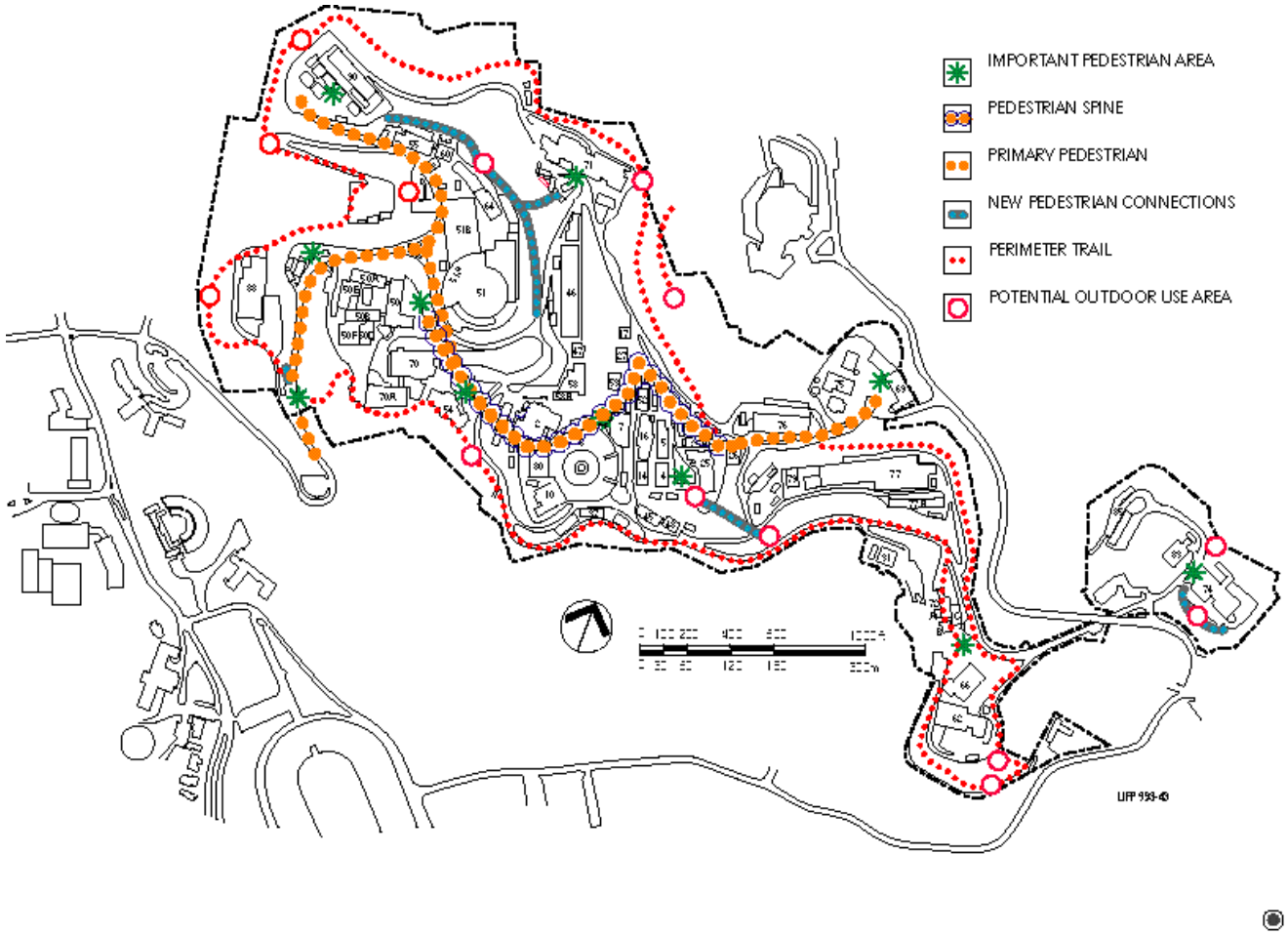


Fig. 4-3. Landscape plan.

FUNCTIONAL PLANNING AREAS

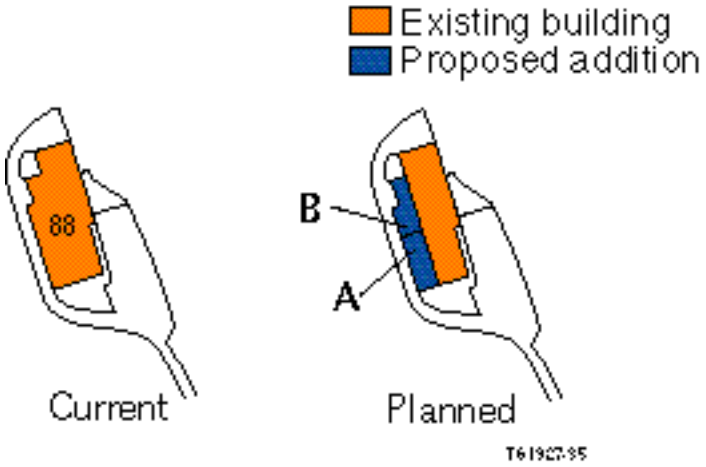
The following section describes the plan changes anticipated for each of the seven functional planning areas. Simplified site plans show the current and planned uses for each area, possible new parking structures, and important outdoor areas. An accompanying Table shows projected increases in gross square meters (footage) and staff populations and summarizes such changes for each area.

Area 1—88-Inch Cyclotron Research Area

Planning Area 1, located on a narrow hillside terrace near the Main Gate, currently includes buildings totaling 4,810 gsm (51,800 gsf). The area is expected to continue to be dedicated to the operation of the 88-Inch Cyclotron and required support facilities. A second floor addition to support users of the National Gammasphere Project is under construction. Future expansion within this area is limited by steep slopes, an active fault, important adjacent vegetation/wildlife habitat, and proximity to residential neighborhoods.

Category/Project	Area (gsf)	Staff (heads)
Existing buildings	51,800	59
Additions/Replacements	10,800	41
Net Total	**62,600**	**90**

Note: Area and staffing plans are for general estimating purposes only.

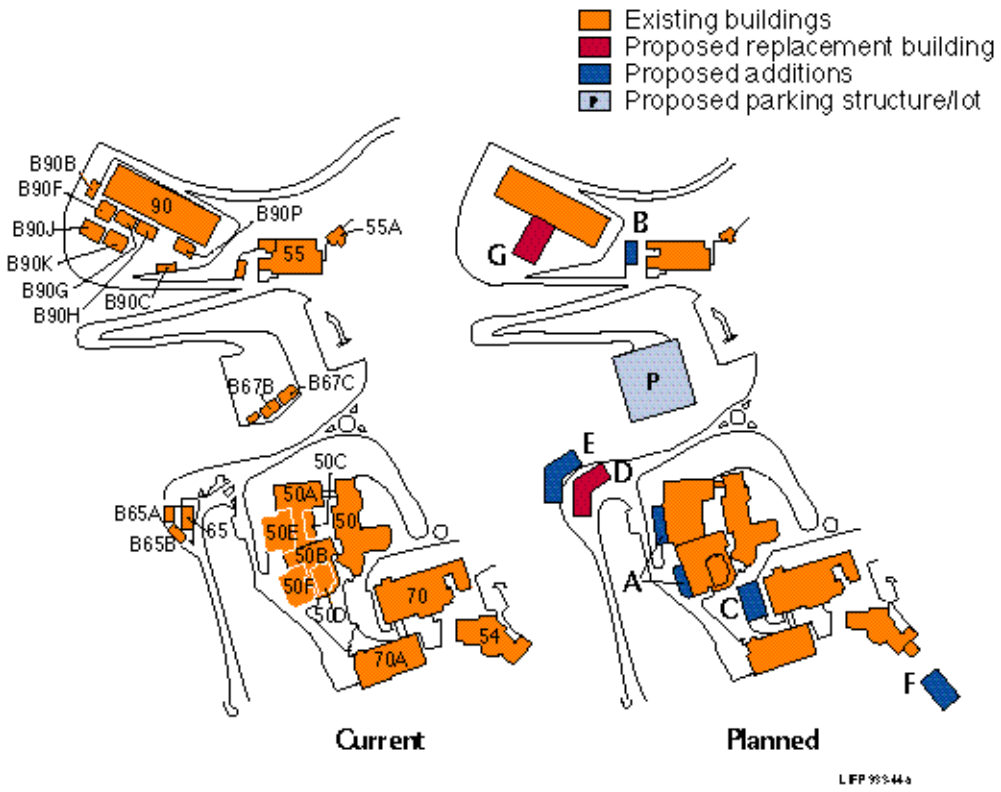


Area1—88-Inch Cyclotron Research Area.

Area 2—Central Research and Administration Area

Planning Area 2 houses the Berkeley Lab Director's Offices and the main offices for Administration, Planning and Development, Accelerator and Fusion Research, Earth Sciences, Energy and Environment, Engineering, Information and Computing Sciences, Nuclear Science, and Physics. Blackberry Canyon divides the area topographically into two components, the Building 50 – 70 complex and the Building 90 complex. The majority of Berkeley Lab's light laboratories and support offices, as well as the cafeteria and reception center, are included within these complexes. Currently the Central Research and Administration Area has a total of 45,140 gsm (485,900 gsf) in building space.

Current plans call for many building projects, including additional floors for Buildings 50E and 50F, a Biomedical Isotope Facility adjacent to Building 55, a new reception center, and the development of a conference facility. An addition to the cafeteria has been funded. A slope stabilization project and seismic rehabilitation of Building 90 is in progress. The Facilities Department, currently located in the Building 90 trailers, is slated for relocation to Planning Area 5 (the Shop and Support Facilities Area). This will free up space currently occupied by trailers for use as parking and circulation. Preliminary studies



Area 2 —Central Research and Administration Area.

have also suggested that the Building 90 parking area has the potential for development of a 1 or 2 level underground parking structure with new buildings and outdoor spaces above. The existing parking lot in Blackberry Canyon is also a proposed site for a future parking structure.

Category/Project	Area (gsf)	Staff (heads)
Existing Buildings	485,900	1,361
Additions/Replacements:	40,700	499
A 2nd-Floor Additions		
B Future Addition		
C Conference Center		
D Reception Center		
E Technology Transfer Bldg.		
F Child Care Center		
G Future Building site		
Net Total	**526,600**	**1,860**

Note: Area and Staffing plans are for general extimating purposes only.

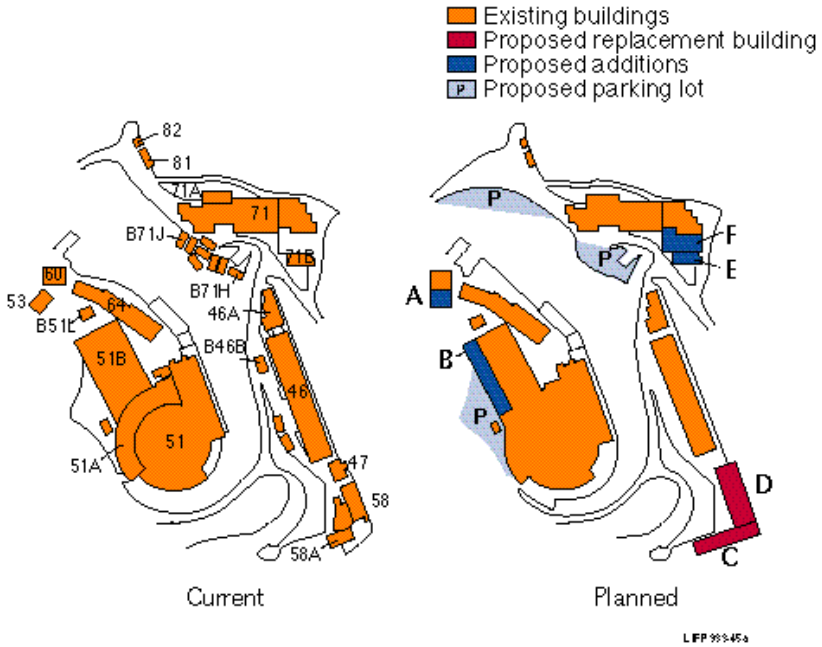
Area 3—Bevalac Accelerator Complex

Planning Area 3 currently includes 33,270 gsm (358,100 gsf) of building space. These facilities are located on three narrow benches separated by steep slopes. Existing facilities include the Bevalac, heavy laboratory experimental areas, Biomedical Isotope Facility, staging areas, associated offices, and facilities for advanced accelerator research and development. The proposed Master Plan anticipates the reuse of the buildings for accelerator facilities and experiments, including Elise.

This area already has an extensive array of support utilities, crane and hoisting equipment and related resources. Proposed new experiments could be located in the existing Experimental Particle Hall (Building 51B) with little or no expansion of existing structures. Eventual decommissioning of the Bevatron and SuperHILAC accelerators and shielding is expected, but the buildings housing these facilities are expected to remain in use. Specific uses will depend on the Laboratory's long-term programmatic needs. Additions are proposed to Building 71/71B and the removal of existing trailers at 71 would free up needed space for parking, circulation and possible future building sites. Replacements for Buildings 47 and 58 are also proposed. All building expansion within this area will be carefully coordinated with Berkeley Lab's ongoing slope stabilization and roadway safety programs.

Category/Project	Area (gsf)	Staff (heads)
Existing Buildings	358,100	374
Additions/Replacements:	100,500	286
A 2nd-Floor Additions		
B Elise		
C Building Replacement		
D High-Bay Additions		
E 3rd Floor Offices		
F Building Addition		
Net Total	**458,600**	**661**

Note: Area and staffing plans are for general estimating purposes only.

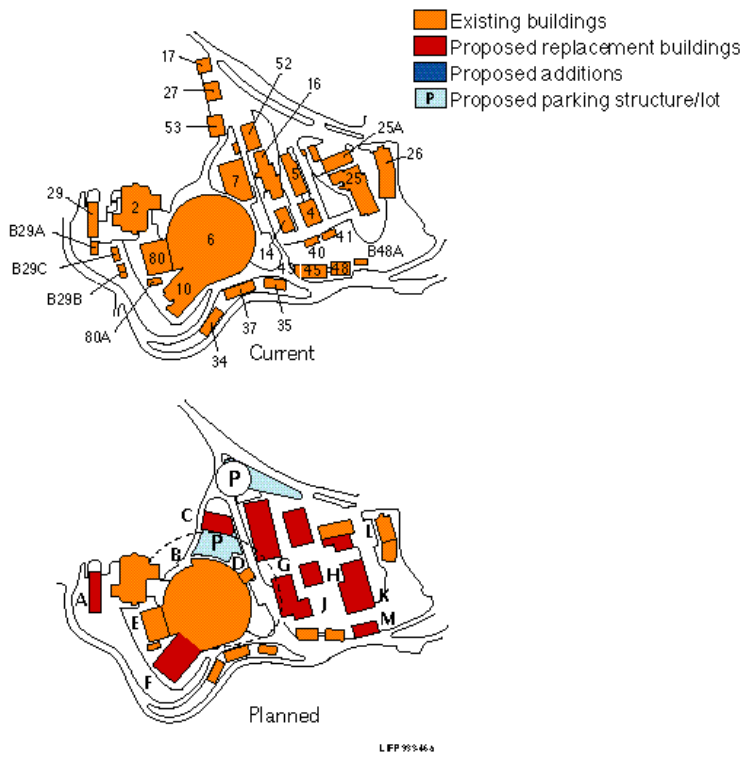


(DRAFT) Area 3 — Bevalac Accelerator Complex.

Area 4—Light Source Research and Engineering Area

Planning Area 4 encompasses approximately 6 hectares (15 acres) with buildings currently totaling 36,940 gsm (397,600 gsf). This area is the original laboratory site and location of the original 184-Inch Cyclotron (Building 6). The building is a landmark which has been remodeled to house the ALS. Projects planned to utilize the ALS facility include the ALS Structural Biology Support Facilities, the Chemical Dynamics Research Laboratory, and the ALS Reception Center. The ALS Beamline Initiative is funded. A special research facility zone has been established around the perimeter of the ALS to reserve areas for programs requiring the use of the ALS photon beams.

Many of the remaining buildings within this planning area were built in the 1940's and are obsolete or hazardous. Current plans call for the removal and replacement of several World War II vintage buildings, including Buildings 29, 25, 5, and 7. New replacement buildings would allow consolidation of activities in the Energy and Environment Division as well as the Mechanical, Engineering and Electronics Engineering Departments.



Area 4 — Light Source Research and Engineering Area

Category/Project	Area (gsf)	Staff (heads)
Existing Buildings	397,600	392
Additions/Replacements:	191,900	854
A 29 Replacement		
B ALS Beamlines Initiative		
C Future Bldg. Site		
D Reception Center		
E ALS Structural Biology Support Facility		
F Chemical Dynamics Res. Lab.		
G Building Replacement		
H Future Building Site		
J Future Bng. Replacement		
K Future Eng. Replacement		
L Circuit Board Shop		
M Research Incubator Facility		
Planned Removals	135,200	236
Net Total	**454,300**	**1,020**

Note: Area and Staffing plans are for general extimating purposes only.

An important consideration in determining new building siting in the area is an existing grove of redwoods which stands west of Building 25. These trees should be preserved as an important artifact of early Laboratory development and included as part of a central outdoor space. Also important is the preservation of views to the Building 6 dome, particularly where this landmark is visible from adjacent urbanized areas. Where practical, new structures within the Light Source Area should not reach a height which causes them to visually compete with the dome.

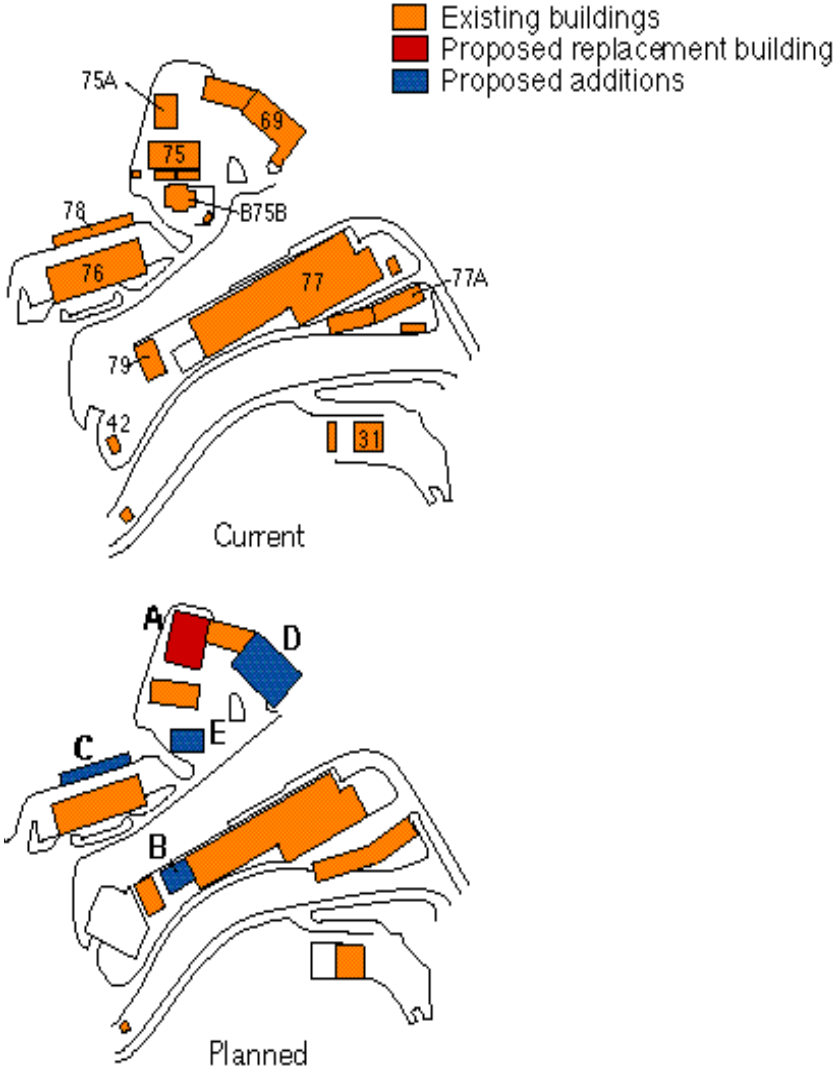
Area 5—Shop and Support Facilities Area

Planning Area 5 currently includes 16,160 gsm (174,000 gsf) of building space in an area adjacent to the Laboratory's Grizzly Gate entrance. Uses currently include Craft, Construction, and Maintenance Shops, Supply Shops, Supply Services, Transportation and Motor Pool, Mechanical Shops, the Environment, Health and Safety Division, and the National Tritium Labeling Facility. The Hazardous Waste Handling Facility is being relocated from this area to Planning Area 7 (the Life Sciences Research Area).

Category/Project	Area (gsf)	Staff (heads)
Existing Buildings	174,000	332
Additions/Replacements:	103,300	250
A Environmental Monitoring Addition		
B 77 Addition		
C 78 2nd-Floor Addition		
D Support Facilities Addition		
E Facilities Management Additions		
Planned Removals	14,500	32
Net Total	**262,800**	**550**

Note: Area and staffing plans are for general estimating purposes only

Consolidation of support facilities will continue with the construction of the Safety and Support Services Facility and a proposed Facilities Building. New building development must take account of public visibility from Centennial Road and be coordinated with slope stabilization and roadway projects that are planned to relieve the area's current congested parking and traffic patterns.



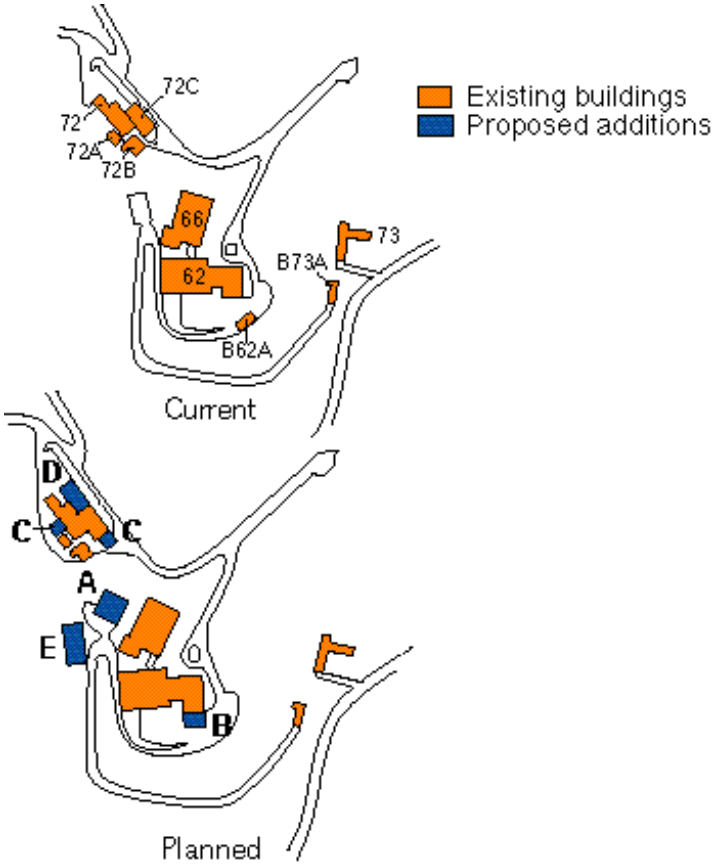
Area 5 — Shop and Support Facilities Area.

Area 6—Materials and Chemistry Research Area

Planning Area 6 includes the Materials and Molecular Research Laboratory, the National Center for Electron Microscopy, and the Surface Science and Catalysis Laboratory. Current building area totals 11,500 gsm (124,000 gsf). Plans include upgrades to the National Center for Electron Microscopy and the need for additional office and laboratory space in this area. All new development must take into account the visibility of this area from campus locations, including Strawberry Canyon below.

Category/Project	Area (gsf)	Staff (heads)
Existing Buildings	124,000	116
Additions/Replacements:	35,800	132
A Future Bldg. Site		
B 62 High-Bay Addition		
C NCEM Addition		
D 72C addition		
E Future Bldg. Site		
Planned Removals	1,900	18
Net Total	**157,900**	**130**

Note: Area and staffing plans are for general estimating purposes only.

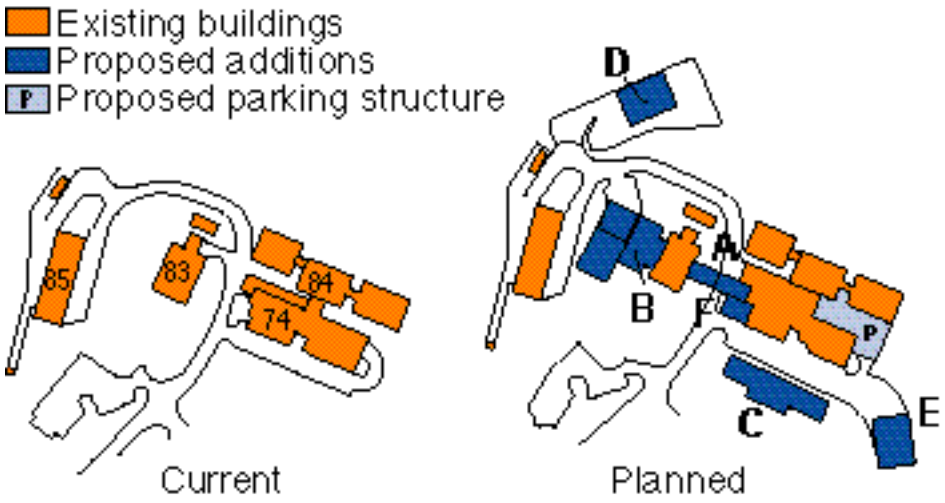


Area 6 — Materials and Chemistry Research Area.

Area 7—Life Sciences Research Area

Planning Area 7 includes 4.4 hectares (11 acres) located in upper Strawberry Canyon in the easternmost portion of the Berkeley Lab site, also known as the East Canyon. Existing buildings include the Cell and Molecular Biology Laboratory, the Laboratory for Cell Biology, the new Hazardous Waste Handling Facility (under construction), and the recently funded Human Genome Laboratory for a total 5350 gsm (57,600 gsf).

Preliminary planning studies have shown significant potential for future expansion in this area. Proposals include the Human Genome Laboratory, expansion of the Life Sciences facilities, and an office/bridge structure to provide safe pedestrian passage between buildings. Several potential building sites have been identified as well as "people places" and possible parking structure locations. Screening of development from public visibility along Centennial Road and protection of an existing grove of native oak and bay trees have been identified as important development objectives.



Area 7—Life Sciences Research Area

Category/Project	Area (gsf)	Staff (heads)
Existing Buildings	57,600	42
Additions/Replacements:	110,900	308
A Bridge/Office Annex '94		
B Cell & Biology Lab. II		
C Future Building Site		
D Future Building Sites		
E Future Building Site		
F Future Building Site		
Planned Removals	500	0
Net Total	**168,000**	**350**

Note: Area and staffing plans are for general estimating purposes only.

GENERAL-PURPOSE CONSTRUCTION PROJECTS

Funded Utility Projects

The following projects are described briefly to identify the major objectives of each in the context of the need to rehabilitate and systematically maintain labwide electrical systems.

- Original Lab-site Substation Project**.** This project, now in construction, will provide a new 12-kV power distribution center and replace existing 12-kV feeder cables in the oldest part of the Laboratory. The existing power-distribution center and feeder cables are beyond their useful life and are unreliable.
- East Canyon Electrical Safety Project East-Canyon Substation and Feeders**.** The Life Science Research Area and the Materials and Chemistry Research Area are currently served by a single 12-kV cable system. This recently funded project will establish a 12-kV power-distribution center near Building 66 and provide new 12-kV cabling to each major facility. Also included will be a new substation for Building 72 (National Center for Electron Microscopy) and an upgrade of the existing substation at Building 74 (Biomedical Laboratory) that serves both Building 74 and Building 83 (Cell Culture Laboratory).

Proposed Electrical Utility Projects

- Blackberry Canyon 12-kV Switching Station and Feeder**.** This project includes a new 12-kV power distribution center near the Bevatron (Building 51) that will initially serve the Central Research and Administration Area and the Bevalac Accelerator Complex. The distribution center will improve the reliability and operational capability of the existing 12-kV distribution system. Also, the existing duct-bank system will be upgraded, and deteriorated cables will be replaced.
- Central Switching Station and Feeders**.** A new 12-kV power-distribution center will be installed near the Building 50 complex to serve the Building 50 complex, Buildings 70 and 70A, the 88-Inch Cyclotron, Building 55 (Research Medicine), and Building 90. New 12-kV power-distribution cables and duct-bank additions will be installed as required to replace existing equipment or to provide increased capacity.
- Upper Blackberry Switch Replacement**.** The Upper Blackberry Switching Station will provide 12-kV interruptible and uninterruptible power to the Building 71 research complex. Included in the project will be new 12-kV feeder cables from the Grizzly main substation, a unit substation to provide low-voltage power, secondary feeder cables, and equipment for power-factor correction.
- Sitewide Electrical Equipment Replacement**.** This project will replace electrical equipment, including transformers, power switches, circuit breakers, switchboards, and motor controls, that is critical to Berkeley Lab's operation and whose failure rate and useful remaining life warrant replacement.

Proposed Mechanical Utility Projects

- Upgrade of Site Mechanical Utilities — Phase II**.** This project is a continuation of Phase I rehabilitation; it includes the addition of a 4-MW cooling-tower cell to the load center serving the Light Source Research and Engineering Area and upgrades to the compressed-air facilities in Buildings 51 and 70.
- Upgrade of Site Mechanical Utilities — Phase III**.** This project extends the Light Source Research and Engineering Area, mechanical-utility corridor, and distribution system. Deteriorated underground piping will be replaced.
- Upgrade of Site Mechanical Utilities — Phase IV**.** Mechanical utilities will be extended to the east canyon area. Deteriorated piping in certain hillside areas will be replaced.
- Upgrade of Site Mechanical Utilities — Phase V**.** Portions of deteriorated utilities will be replaced sitewide. A 300,000-gallon water tank above the Buildings 74-83 complex will be constructed for added fire protection.
- Replace Cooling Towers and Chillers. This project replaces 15 cooling towers and 9 refrigeration chillers that are more than 20 years old.
- Sitewide Mechanical Equipment Replacement — Phase I**.** Portions of building mechanical equipment and systems having the most serious deficiencies will be replaced, including boilers, air handlers, automatic controls, deionized-water units, air compressors, ducts, and piping.

Proposed Construction Projects—General Purpose

- Building 50E & F Addition. This addition is vital for providing office space to house staff for meeting new DOE management and administrative requirement and to consolidate staff from off-site leased space for improved operational efficiency and overhead cost control.
- Facilities Building. This facility is vital for consolidation of Plant Engineering and Construction and Maintenance Personnel. The facilities would result in improved resource managements cost and overhead control, elimination of temporary trailers, and demolition of substandard structures.
- Energy and Environment Building. This facility will allow for consolidation of energy and environment and earth sciences research programs, and other research programs housed in substandard facilities. This modernization project would result in the demolition of substandard space and temporary structures.
- Science Education and Visitor Center. This facility would provide for office, training, conference and displays for Science and Engineering Education Center personnel, for teacher and for students, and for visitors to the laboratory. The facility would allow for a consolidation of programs and provide adequate space for on-site functions that now may be relocated off site due to lack of space.

Other Health and Safety Projects

- Safety and Support Services Facility**.** This building will be a three-story structure of 42,000 gsf to be occupied by the Environmental Health and Safety, Materiel Management, and Electronics Engineering Departments. Three old substandard buildings and five trailers will be removed.
- Environmental Monitoring and Industrial Hygiene Building. This project will provide adequate space to meet DOE requirements for monitoring, safety seminars, industrial hygiene, occupational health, radiation safety, waste minimization, environmental protection and remediation, hazardous waste management, and EH&S training needs. The project responds to deficiencies in facilities and equipment identified by the 1990 Technical Safety Appraisal and the 1991 Tiger Team Assessment.

- Traffic Circulation and Parking Improvements**.** Road rehabilitation is required to facilitate the efficient and safe movement of people and materials throughout the site. Roads need to be widened, base materials need to be replaced to handle current traffic loadings, acute curves and blind spots need to be eliminated, and roadways on steep hillsides need to be stabilized. To improve safety and appearance a study of signs on the Berkeley Lab site is being conducted. A sign plan will be developed based on the results of this study. The plan calls for two phases of road rehabilitation (funded by MEL-FS).

PROGRAM-**R**ELATED **C**ONSTRUCTION **P**ROJECTS

Funded Construction Projects—Program Related

- Human Genome Laboratory. When complete, this facility, an essential component of the Human Genome Center at Berkeley Lab, will be located in the Life Sciences Research Area. This location provides direct access via Centennial Drive to the UCB Campus, where major Berkeley Lab research facilities are situated at Donner Laboratory and the Chemical Biodynamics Laboratory. The Life Sciences Research Area now includes existing cell and molecular biology research facilities in the Biomedical Laboratory, Building 74, and the Cell and Biology Laboratory, Building 83, that are used for related research on gene expression and hemopoiesis. Modifications and additions to these buildings are now underway to provide facilities for human genome research and for relocation of Life Sciences Research from Building 934 to this area.
- ALS Structural Biology Support Facilities**.** This facility will provide two ALS beamlines and support space for specimen preparation and support services for visiting university and industry scientists and core Berkeley Lab personnel. Work includes renovation of Building 80 and additional construction within Building 6.

Proposed Construction Projects—Program Related

- Chemical Dynamics Research Laboratory. This proposed facility would combine photon beams from the ALS with advanced laser and molecular beam apparatus to explore the interaction of radiation with matter at the molecular level.
- Elise. Elise will be the largest ion induction accelerator ever built, producing intense beams of heavy ions for heavy-ion fusion research.
- Electron Beam Microcharacterization Facility (EBMF). This national user facility will be an integral part of the DOE's National Center for Electron Microscopy. The EBMF will be used to establish links between microstructure and properties of solids for a broad range of materials important for fundamental science and new technologies.
- Bevalac. The Bevalac is to be decommissioned. The initial phase of securing the facility will be funded by the office of Energy Research. The decommissioning program for the accelerator and its shielding would be supported by the office of Environmental Restoration and Waste Management.

GENERAL **P**LANT **P**ROJECTS

Over the last 20 years, Berkeley Lab has found it necessary to rely upon General Plant Projects (GPP) funding for almost all improvements, replacements, and maintenance and repair projects for physical-plant facilities that required capital funding. Berkeley Lab has used its GPP funds to solve problems related to seismic safety, fire protection, and industrial safety. In addition, required small capital additions or modifications required for program initiatives were accomplished with GPP funds.

General deterioration and obsolescence of Berkeley Lab facilities, which are among the oldest found at national laboratories, has been unarrested in the past, and the backlog of deficiencies has continued to grow. The average age of Berkeley Lab buildings is now 30 years, and many basic utility load centers and distribution systems are now over 40 years old. The Laboratory is in a situation where very significant financial outlays are required to bring the Laboratory's infrastructure into compliance with current code and regulatory requirements. Points of concern include fire and life safety improvements, 12 kV cabling upgrades, new radio communication system towers, conduit extensions, and, over the next several years, small building modifications and additions.

With GPP funds at the $3.3-M level, many code-related upgrades and physical plant projects cannot be funded; progress in increasing GPP funding to $6.0 M/year is needed to ensure the success of the Laboratory's rehabilitation program. These increased funds would be used for essential infrastructure, environmental health and safety needs, and multiprogram and small programmatic initiatives.

MAINTENANCE

Many of Berkeley Lab's facility-related maintenance costs stem from aged and obsolete buildings and deteriorated utilities. This plan calls for about 10,220 gsm (110,000 gsf) of World War II structures that require excessive maintenance to be demolished as soon as economically practical.

Berkeley Lab has carried out a formal maintenance management program for over 30 years and has operated a computerized scheduled maintenance system for more than 25 years. Budget requests are based upon plant facilities inspections coupled with special engineering studies and reviews by Berkeley Lab's Facilities Department and consulting firms. Maintenance management addresses both routine and specialized areas such as cranes, elevators, boilers and pressure vessels, fire protection, slope stability, storm drainage, seismic safety, industrial safety, and underground utilities. An annual work plan and a budget are developed for review at three management levels before being approved at the directorate level.

The formulation of the maintenance budget is an iterative process that considers related work plans for noncapital alterations, general plant projects, multiprogram general-purpose line items, and regular line item construction. This process begins with a zero-base budget study, includes consideration for other operating budget priorities, and culminates in a formalized work plan for the fiscal year. Since maintenance and repair requirements are also generated continuously throughout the fiscal year, a formal system provides for timely consideration and processing of these requirements.

Long-range work plans are being developed for items of major maintenance, such as reroofing, paving, slope-stabilization projects, major equipment-overhaul projects, rehabilitation, building exterior painting, and utilities replacements. A five-year projection is made annually with specific projects itemized over the first three years and lumped for the last two.

The strategy for accomplishing environmental improvements, required repairs, and upkeep relies on increasing capital outlays and streamlining the existing maintenance program to make it more cost effective. Emergency replacements that may be necessary during the next few years can be achieved only with operating funds. Recent changes in the GPE funding guidance restrict the Laboratory's use of this funding option and create a significant strain on operating funding. Funding for planned equipment replacements is inadequate. A maintenance engineer has improved Berkeley Lab scheduled maintenance and repairs to increase awareness of priorities for capital repairs and replacements and to develop long-term planning mechanisms. Laboratory management is developing long-term plans for sustaining Berkeley Lab facilities. The funding required to maintain the Laboratory buildings must be identified. Replacement funds for the projects which previously qualified for GPE funding is needed. The need for infrastructure operating funds is a serious concern.

Vegetation Management

The Laboratory's open space buffer zones require continued management to maintain overall site quality. A major safety concern is the seasonal high risk of fire, particularly in areas where large groves of eucalyptus and Monterey pine trees predominate. Berkeley Lab has developed a program to address vege-

tation/fire management needs and requirements. Existing trees are being managed for fire hazard by judicious pruning to avoid building contact or overhang and to prevent 'laddering' of fire into canopies. Other initial priority measures have been completed, and a vegetation maintenance program will be formulated for the less-developed areas of the site. A revegetation plan is now under preparation. It will incorporate selective replacement of more flammable species and the use of "mosaic" fire breaks.

The transition between open space buffer zones and developed areas is an important component of overall landscape management. The Landscape Plan has identified four levels of management which will facilitate landscape transitions and concentrate resources in high use areas (Table 4-2).

A comprehensive vegetation plan to ensure long term continuity of Berkeley Lab's landscape values will include a thoughtful reforestation program. Replacement trees should be selected for important characteristics such as height, long life, and fire resistance and located with future growth in mind. Trees lost or removed in recent years will be selectively replaced. Many of the Laboratory's tree stands are single-age groups planted more than 50 years ago. Reforestation plans will encompass selective removal and replacement needs as the trees begin to decline. In addition, because of the long lead time involved in attaining tree growth, the forestation needs of future building sites will be incorporated into the plan.

Table 4-2. Landscape Master Plan Management Levels.

Special Treatment
Along well-travelled routes
Managed for public image, place-making, orientation
Clearly perceived as important areas
Highest maintenance
Ornamental plantings
Supplemental summer water
Cultivated
Adjacent to buildings, use areas
Managed for aesthetics, high use
Has perceived order or style
Regular maintenance
Native and non-native plantings
Supplemental summer water
Rural
Near buildings
Managed for safety, environment, low use
Informal, rural character
Low maintenance
Drought-tolerant, fire resistant
Native and naturalized plants
Little or no supplemental summer water
Natural State
Most distant from buildings
Uncultivated character
Managed for safety, habitat
Minimal maintenance
Horticulturally consistent
Visually compatible with adjacent open space
No supplemental summer water

5. TEN-YEAR PLAN

PLANNING ASSUMPTIONS AND RATIONALE

The Master 20-Year Plan described in Chapter 4 provides the institutional and strategic planning framework for making informed decisions for the long term. Chapter 5 describes near-term facilities needs based on current assessment of requirements. Resources, and the resulting patterns of construction and development dependent on these resources, may vary from year to year, and priorities are adjusted accordingly. Specific construction projects, improvements, and demolitions and removals are described below.

Site and facilities planning for the 5-year period is based on the *Ernest Orlando Lawrence Berkeley National Laboratory Institutional Plan, FY 1994–1999*, prepared in October 1993. Projects are derived from the Laboratory's response to DOE's national program plans and represent either important new facilities or the rebuilding of existing infrastructure to accommodate research and support activities. Five-year plans provided by the Office of Energy Research for each of its Research Program Offices and other DOE Assistant Secretarial Offices are also used.

To address critical needs, the Laboratory analyzes projects identified by both research and support staff as having environmental, health, and safety implications and/or as having the potential to interrupt research programs. The current funds from all sources are inadequate to fill all of the identified needs within a single fiscal year or even within the five-year planning period. Priorities are reviewed by the Project Coordination Committee and confirmed by the Director's Action Committee and coordinated with the DOE Oakland Operations Office and UC.

The Ten-Year Plan is based primarily on capital funding from Programmatic, MEL-FS, GPP, and GPE sources (Tables 5-1 and 5-2). Other sources of funding are IHEM Funds and operating funds from the ERWM Program. A detailed analysis of needs has been completed by Laboratory staff for each of these funding categories. Needs for GPE and GPP far exceed the expected funding. MEL-FS needs

Table 5-1. Programmatic Facilities (Fiscal Year, $M).

Project Title	Total Estimated Cost (TEC)	Schedule
Human Genome Laboratory (KP)	24.7	1994–1997
Induction Linac Systems Experiments (AT)	44.0	1993–1998
ALS Structural Biology Support Facilities (KP)	55.0	1995–1997
Chemical Dynamics Research Laboratory (KC)	48.8	1995–1998

Table 5-2. Ten-year Capital Improvement Plan (Fiscal Year, $M).

Category	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
MEL-FS	17.6	31.9	27.5	18.0	22.9	27.2	27.5	32.7	25.9	13.1
GPP	4.0	6.6			6.6					
GPE	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8

and funding resources have similar disparities. To maximize the strategic investment in plant and equipment, the Laboratory's MEL-FS and GPE needs have been categorized and prioritized (Figures 5-1 and 5-2). MEL-FS and GPP funding from FY 1994 through FY 2000 is shown in Figure 5-3.

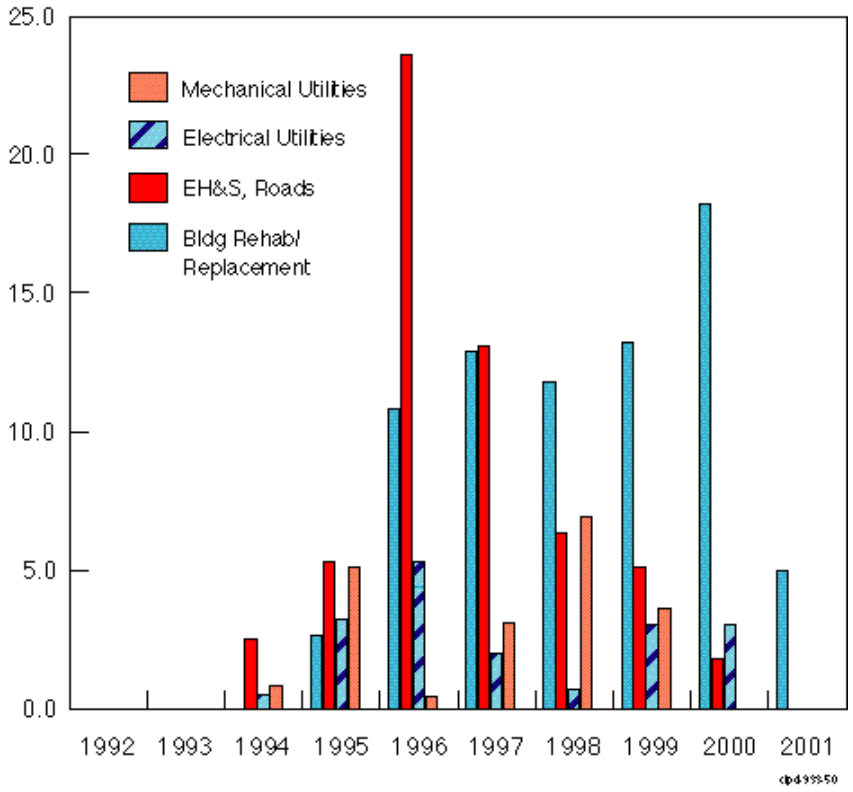


Fig. 5-1. Ten-year MEL-FS backlog.

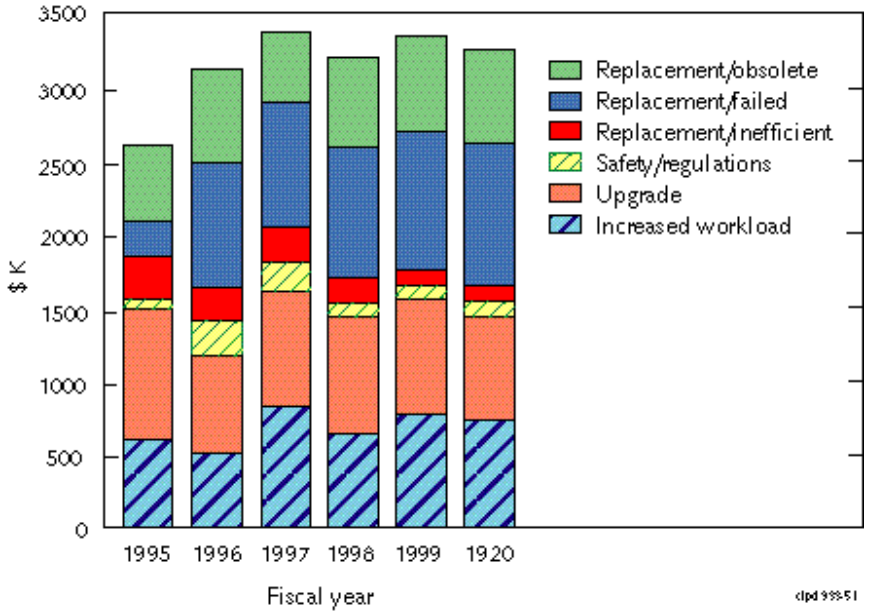


Fig. 5-2. Five-year GPE needs.

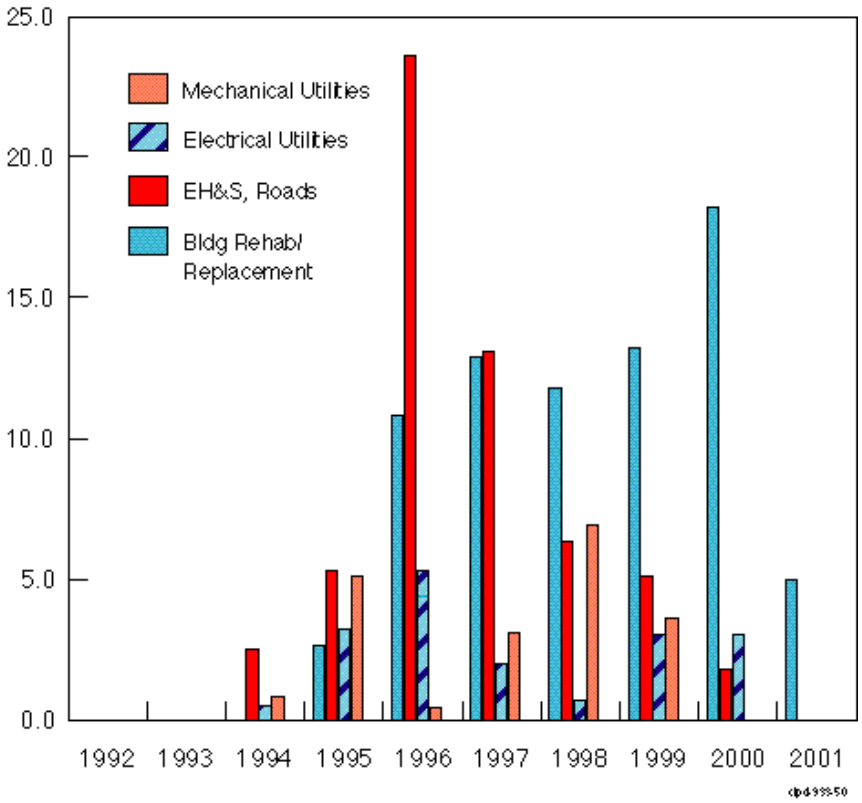


Fig. 5-3. Ten-year MEL-FS backlog.

TEN-YEAR PROGRAMMATIC AND MEL-FS PLANS

Table 5-3 lists the capital funding profiles for individual projects through 2001. Figure 5-4 shows the proposed changes to the site for this period. Actual project starts are subject to funding constraints and subsequent changes in priority. The Ten-Year Plan is in concert with the Master 20-Year Plan in that incremental additions, replacements, or improvements are all tested for conformance to the established Design Guidelines and Site Planning Concepts. Furthermore, information such as the Landscape Plan and the Old Town Site Utilization Study is continually incorporated into planning and analysis when made available.

Tables 5-4 and 5-5 present alternative funding scenarios, which assume yearly funding of $11 million and unconstrained, respectively.

Table 5-3. Lawrence Berkeley Laboratory construction plan, FY 1996–FY 2000.

FY	Project	Scope	TEC	Prior*	1996	1997	1998	1999	2000	2001	2002
Plan for programmatic and general purpose facilities, including funded, budgeted and proposed construction (FY BA, $M)											
	FUNDED PROGRAM RELATED PROJECTS:										
94	Human Genome Laboratory (KP)	3,809 gsm (41,000 gsf)	24.700	17.934	5.766	1.000					
	ALS Structural Biology Support Facilities	1,031 gsm (11,100 gsf)	7.900	5.282	2.618						
	SUBTOTAL - FUNDED PROGRAM RELATED		**32.600**	**23.216**	**8.384**	**1.000**					
	FUNDED MEL-FS PROJECTS (KG):										
93	Fire & Safety Systems Upgrade Proj. Ph I		4.600	3.470	1.130						
	Hazardous Materials Safeguards, Ph. I		4.720	3.432	1.288						
	SUBTOTAL - FUNDED MEL-FS PROJECTS		**9.320**	**6.902**	**2.418**						
	FUNDED ERWM PROJECTS:										
88	Hazardous Waste Handling Facility**	1,198 gsm (12,900 gsf)	12.625	12.454	0.171						
	SUBTOTAL - FUNDED ERWM PROJECTS		**12.625**	**12.454**	**0.171**						
	TOTAL FUNDED		**54.545**	**42.572**	**10.973**	**1.000**					
	BUDGETED MEL-FS PROJECTS (KG)										
94/95	No new project starts in FY 1995										
	TOTAL FUNDED and BUDGETED		**54.545**	**42.572**	**10.973**	**1.000**					
	PROPOSED PROGRAM RELATED PROJECTS:										
96	ALS Beamlines Initiative (KC)	1,877 gsm (20,200 gsf)	52.6		11.6	23.9	17.1				
	Elise (AT)	595 gsm (6,400 gsf)	20.2		5.0	5.4	5.6	4.2			
	Chemical Dynamics Research Laboratory (KC)	3,066 gsm (33,000 gsf)	61.9		7.8	18.4	17.7	11.8	6.2		
	NCEM Electron Beam Microchar Facility (KC)	900 gsm (10,000 gsf)	15.9		1.0	7.8	6.7	0.4			
	TOTAL - PROPOSED PROGRAM RELATED		**150.6**		**25.4**	**55.5**	**47.1**	**16.4**	**6.2**		

Table 5-3. Lawrence Berkeley Laboratory construction plan, FY 1996–FY 2000.

FY	Project	Scope	TEC	Prior*	1996	1997	1998	1999	2000	2001	2002
	PROPOSED MEL-FS PROJECTS:										
96	Safety & Support Services Facility	2,990 gsm (32,200 gsf)	12.8		1.4	0.8	10.0	0.6			
	Upgrd of Site Mech Util, Ph II - Sewer Monit		8.4		1.0	3.6	3.7	0.1			
	Sanitary Sewer Restoration	1,036 m (3,400 ft)	2.4		0.4	1.6	0.4				
	Mechanical Equipment Replacement, Ph I		4.5		0.5	3.8	0.1	0.1			
97	Envir Monitoring & Industrial Hygiene Bldg	2,973 gsm (32,000 gsf)	24.9			4.0	9.0	7.0	4.9		
	Roadway Safety & Stabilization, Phase I		7.0			1.0	3.0	2.0	1.0		
	Berkeley Lab Communcns Conduit Infrastruc Impvmts		3.8			0.6	2.0	1.0	0.2		
	Upgrade Berkeley Lab Radio Communications System		4.7			0.7	2.3	1.0	0.7		
	Facilities Building	2,657 gsm (28,600 gsf)	16.5			2.5	6.0	4.5	3.5		
98	Medical Serv Asbestos Abatement & Rehab		3.2				0.3	2.1	0.8		
	Roof Replacements, Ph II		7.5				0.7	3.8	3.0		
	Elec Sys Rehab, Ph IV - BBC Swch Sta Replc		7.4				0.7	3.6	3.1		
	Old Town Parking Structure	3,252 gsm (35,000 gsf)	3.0				0.3	1.6	1.1		
99	Blackberry Canyon Parking Structure		23.0					3.5	7.0	7.0	5.5
	Admin Services Addn - Bldg 50E/F 2nd Fl	1,709 gsm (18,400 gsf)	9.4					1.4	3.0	3.0	2.0
	Fire & Safety Systems Upgrd Project, Ph II		5.7					0.9	2.4	2.4	
	Hazardous Materials Safeguards, Phase II		8.1					1.2	3.5	3.4	
00	Research Incubator Facility		13.8						1.8	6.0	6.0
	Technology Transfer Building		9.2						1.2	5.0	3.0
	Maintenance Bldg Replcmt, Ph I - Bldg 76	2,787 gsm (30,000 gsf)	6.5						0.6	3.1	2.8
	SUBTOTAL - PROPOSED MEL-FS PROJECTS		**181.8**		**3.3**	**18.6**	**38.5**	**34.4**	**37.8**	**29.9**	**19.3**
	TOTAL FUND, BUDGT & PROP MEL-FS PROJ		**191.1**	**6.9**	**5.7**	**18.6**	**38.5**	**34.4**	**37.8**	**29.9**	**19.3**

*Prior costs from previous years.

**Request $171K in FY96 based on the recision of this amount in the FY93 Budget.

August 1993 escalation rates @ FY96 3.9%, FY97 3.8%, FY98 3.6%, FY99 and beyond 3.7%. Elise uses Feb 1994 escalation. Overhead @8.61% on TEC.

Overhead factor is subject to change.

Long-term projects also under consideration are IsoSpin Laboratory, National Biomedical Tracer Facility, Molecular Design Institute, and Building Technology Initiative.

4/12/94

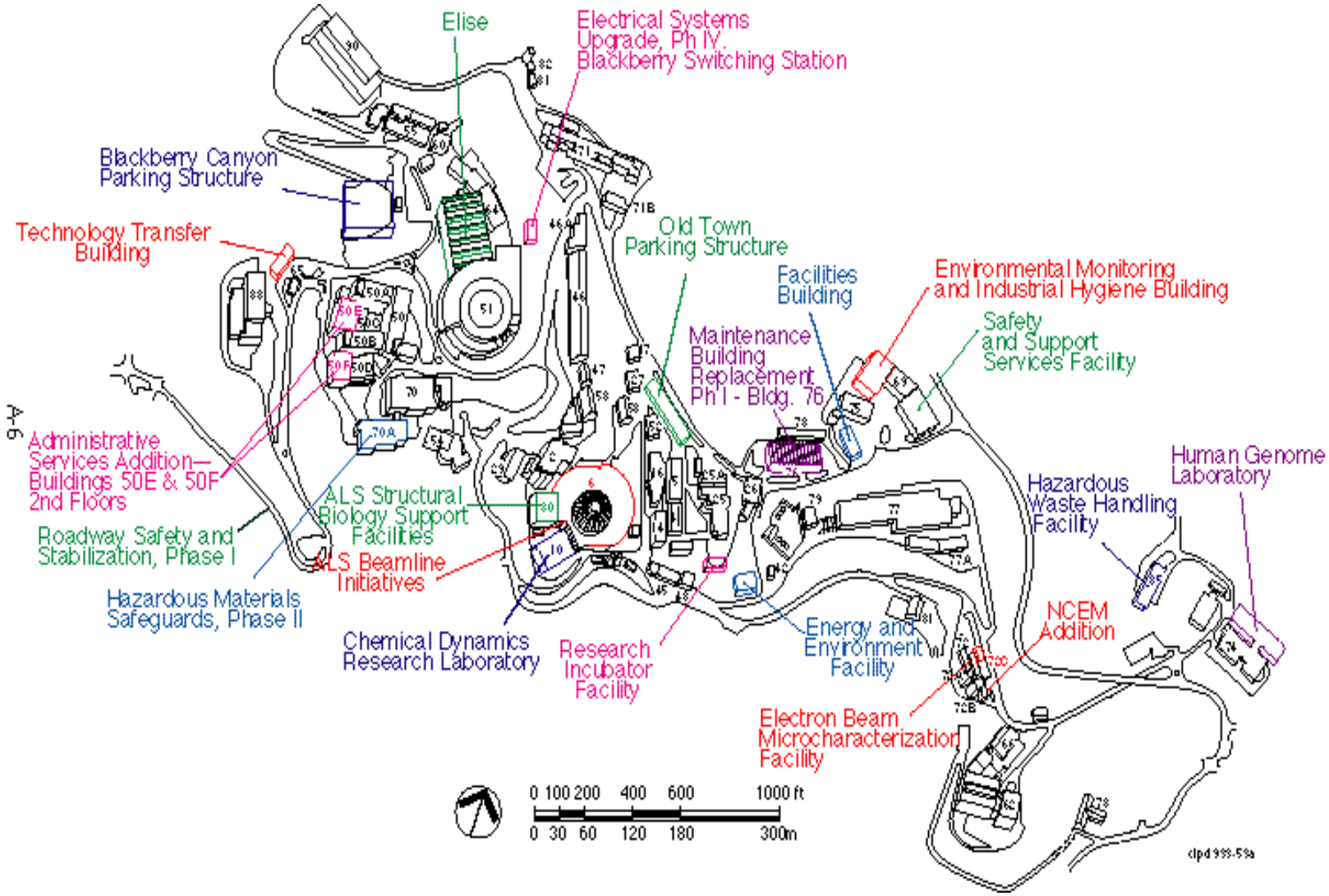


Fig. 5-4. Proposed major construction projects FY 1996–FY 2000.

Table 5-4. Ten-year MEL-FS project plan – $11 million scenario (1996–2005).

FY	Project	CAMP Rating	Goals 1	2	3	4	5	Functional Unit Code	Subprog	$ M TEC	Prior*	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
	FUNDED MEL-FS PROJECTS:																						
88	Environmental, Health & Safety									13.163	11.472	1.691											
92	East Canyon Electrical Safety Project									3.900	1.332	1.568	1.000										
93	Fire & Safety Systems Upgrade Proj, Ph I								TTR	4.600	0.500	1.000	2.000	1.100									
	Hazardous Materials Safeguards, Ph I								TTR	4.720	0.500	0.970	1.962	1.288									
	SUBTOTAL - FUNDED MEL-FS PROJECTS									**26.383**	**13.804**	**5.259**	**4.962**	**2.358**									
	BUDGETED MEL-FS PROJECTS (KG)																						
94/95	No new project starts in FY 1994 or FY 1995.																						
	SUBTOTAL - BUDGETED MEL-FS PROJ									**0.000**	**0.000**	**0.000**	**0.000**	**0.000**									
	TOTAL FUNDED and BUDGETED									**26.383**	**13.804**	**5.259**	**4.962**	**2.358**									
	PROPOSED MEL-FS PROJECTS:																						
96	Safety & Support Services Facility	67.1	•		•	•	•	10-Admin	GPF-EHS	12.8				5.0	5.6	2.2							
	Upgrd of Site Mech Util, Ph II - Sewer Monit	65.2	•	•	•	•	•	37-Distrb Sys	GPF-EHS	8.4				3.6	4.1	0.7							
														11.0									
97	Sanitary Sewer Restoration	65.2	•	•	•		•	37-Distrb Sys	GPF-Other	2.8					0.5	1.7	0.6						
	Mechanical Equipment Upgrade, Ph I	63.4	•	•	•		•	15-R&D Blds	GPF-Other	5.0					0.8	3.6	0.6						
															11.0								
98	Roadway Safety & Stabilization, Phase I	64.5	•	•		•	•	30-Transp Sys	GPF-EHS	8.5						1.4	4.5	2.6					
	Roof Replacements, Ph II	64.5	•	•			•	15-R&D Blds	GPF-Bldg	8.4						1.4	4.3	2.7					
																11.0							
99	Berkeley Lab Communications Conduit	63.4	•	•	•		•	36-Com/ Secur	GPF-Other	4.6							0.4	2.1	1.8	0.3			
	Infrastructure Impv																						
	Upgrade of Berkeley Lab Radio Communications Sys	63.4	•	•	•		•	36-Com/ Secur	GPF-EHS	5.9							0.6	2.5	2.3	0.5			
																	11.0						
00	Medical Serv Asbestos Abatement & Rehab	58.0	•	•	•	•		10-Admin	GPF-EHS	3.6								0.4	2.1	1.1			
	Elec Sys Upgrade, Ph IV - Blkby Swit Sta Replc	63.3	•	•	•	•	•	37-Distrb Sys	GPF-Elec	7.9								0.7	3.4	2.8	1.1		
																		11.0					
01	Fire & Safety Systems Upgrd Project, Ph II	64.5	•	•	•			15-R&D Blds	TTR	6.1									0.6	2.6	2.1	0.8	
	Roadway Safety & Stabilization, Phase II	64.5	•	•	•		•	30-Transp Sys	GPF-EHS	7.7									0.8	3.2	3.0	0.7	
																			11.0				
02	Seismic Safety Improvement Project	64.5	•	•				15-R&D Blds	GPF-EHS	5.2										0.5	3.4	1.3	
																				11.0			
03	Roof Replacements, Ph III	64.5	•	•			•	14-Svc Blds	GPF-Bldg	9.3											1.4	3.3	1.5
																					11.0		
04	Envir Monitoring & Industrial Hygiene Bldg	66.8	•		•	•	•	10-Admin.	GPF-EHS	38.3												4.9	9.0
																						11.0	
05	Fire and Safety Systems Upgrade, Phase III	64.5	•	•	•		•	15-R&D Blds	TTR	6.7													0.5
																							11.0

August 1993 escalation rates at 2.6%, FY'93; 3.4%, FY'94; 4.0%, FY'95; 3.9%, FY'96; 3.8%, FY'97; 3.6%, FY'98; 3.7%, FY'99; 3.7%, subsequent years.
Includes an 8.61% Overhead Factor (on TEC). Overhead Factor is subject to change.
*= prior costs from previous Fiscal Years

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Table 5-5. Ten-year MEL-FS project plan – unconstrained funding scenario (1996–2005).

FY	Project	CAMP Rating	Goals 1	2	3	4	5	Functional Unit Code	Subprog	TEC	Prior*	$M 1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
	FUNDED MEL-FS PROJECTS:																						
88	Environmental, Health & Safety									13.163	11.472	1.691											
92	East Canyon Electrical Safety Project									3.900	1.332	1.568	1.000										
93	Fire & Safety Systems Upgrade Proj, Ph I								TTR	4.600	0.500	1.000	2.000	1.100									
	Hazardous Materials Safeguards, Ph I								TTR	4.720	0.500	0.970	1.962	1.288									
	SUBTOTAL - FUNDED MEL-FS PROJECTS									**26.383**	**13.804**	**5.229**	**4.962**	**2.388**									
	BUDGETED MEL-FS PROJECTS (KG)																						
94/95	No new project starts in FYs 1994 or 1995.																						
	SUBTOTAL - BUDGETED MEL-FS PROJ									**0.000**	**0.000**	**0.000**	**0.000**	**0.000**									
	TOTAL FUNDED and BUDGETED									**26.383**	**13.804**	**5.229**	**4.962**	**2.388**									
	PROPOSED MEL-FS PROJECTS:																						
96	Safety & Support Services Facility	67.1	•		•	•	•	10-Adm Blds	ES&H	12.8				1.4	0.8	10.0	0.6						
	Upgrd of Site Mech Util, Ph II - Sewer Monit	65.2	•	•	•	•	•	37-Distrb Sys	ES&H	8.4				1.0	3.6	3.7	0.1						
	Sanitary Sewer Restoration	65.2	•	•	•		•	37-Distrb Sys	GPF-Other	2.4				0.4	1.6	0.4							
	Mechanical Equipment Upgrade, Ph I	63.4	•	•	•		•	15-R&D Blds	GPF-Other	4.5				0.5	3.8	0.1	0.1						
97	Envir Monitoring & Industrial Hygiene Bldg	66.8	•		•	•	•	10-Adm Blds	ES&H	24.9					4.0	9.0	7.0	4.9					
	Roadway Safety & Stabilization, Phase I	64.5	•	•		•	•	30-Transp Sys	ES&H	7.0					1.0	3.0	2.0	1.0					
	Berkeley Lab Communications Conduit Infrastrctr Impvmts	63.4	•	•	•		•	36-Com/Secur	GPF-Other	3.8					0.6	2.0	1.0	0.2					
	Upgrade of Berkeley Lab Radio Communications System	63.4	•	•	•		•	36-Com/Secur	ES&H	4.7					0.7	2.3	1.0	0.7					
	Facilities Building	63.8	•		•	•	•	10-Adm Blds	GPF-Bldg	16.5					2.5	6.0	4.5	3.5					
98	Medical Serv Asbestos Abatement & Rehab	58.0	•	•	•	•		10-Adm Blds	ES&H	3.2						0.3	2.1	0.8					
	Roof Replacements, Ph II	64.5	•	•			•	15-R&D Blds	GPF-Other	7.5						0.7	3.8	3.0					
	Elec Sys Rehab, Ph IV - BBC Swch Sta Replc	63.3	•	•	•	•	•	37-Distrb Sys	ES&H	7.4						0.7	3.6	3.1					
	"Old Town" Parking Structure	59.0	•	•		•	•	30-Transp Sys	GPF-Bldg	3.0						0.3	1.6	1.1					
99	Blackberry Canyon Parking Structure	59.0	•	•		•	•	30-Transp Sys	GPF-Bldg	23.0							3.5	7.0	7.0	5.5			
	Admin Services Addn - Bldg 50E/F 2nd Fl	57.1		•		•	•	10-Adm Blds	GPF-Bldg	9.4							1.4	3.0	3.0	2.0			
	Fire & Safety Systems Upgrd Project, Ph II	64.5	•	•	•			15-R&D Blds	ES&H	5.7							0.9	2.4	2.4				
	Hazardous Materials Safeguards, Phase II	60.0	•	•	•			15-R&D Blds	ES&H	8.1							1.2	3.5	3.4				
00	Research Incubator Facility	60.0			•	•	•	15-R&D Blds	GPF-Bldg	17.8								1.8	6.0	6.0	4.0		
	Technology Transfer Building	60.0			•	•		10-Adm Blds	GPF-Bldg	11.9								1.2	5.0	3.0	2.7		
	Maintenance Building Replacement, Ph I-Bldg 76	60.0	•	•	•			14-Svc Blds	GPF-Bldg	6.5								0.6	3.1	2.8			
01	Building Sys. Upgrade, Ph I - Bldg 90,50,50B	55.0	•	•	•		•	15-R&D Blds	ES&H	12.0									1.5	4.5	4.0	2.0	
	Roadway Safety & Stabilization, Phase II	64.5	•	•	•		•	30-Transp Sys	ES&H	7.7									1.0	3.7	3.0		
	Fire and Safety Systems Upgrade, Phase III	64.5	•	•	•		•	15-R&D Blds	ES&H	5.8									0.8	2.5	2.5		
02	Bldg. 50 Auditorium Expansion	63.3	•	•	•	•		10-Adm Blds	GPF-Bldg	8.8										0.9	3.5	3.3	1.1
	Mechanical Equipment Upgrade, Phase II	63.3	•	•	•		•	15-R&D Blds	GPF-Other	5.4										0.5	2.8	2.1	
	Roof Replacements, Ph III	64.5	•	•			•	14-Svc Blds	GPF-Other	9.0										0.9	3.7	3.4	1.0
03	Mechanical Utilities Upgrade, Phase II	57.6	•	•	•	•	•	37-Distrb Sys	ES&H	9.5											0.9	4.9	3.7
	Maintenance Building Replacement, Ph II- Bldg 78	60.0	•	•	•	•		10-Adm Blds	GPF-Bldg	5.4											0.6	2.8	2
	Day Care Facility	55.0				•		10-Adm Blds	GPF-Bldg	5.8											0.6	3.0	2.2
	Seismic Safety Improvement Project	64.5	•	•				15-R&D Blds	ES&H	5.4											0.5	2.8	2.1
04	Applied Sciences Building	60.0	•		•	•	•	15-R&D Blds	GPF-Bldg	26.8												4.0	13.9
05	Roadway Safety & Stabilization, Phase III	64.5	•	•		•	•	30-Transp Sys	ES&H	9.7													0.9
	Science Education and Visitor Center	60.0			•	•		10-Adm Blds	GPF-Bldg	11.1													1.1
	Building Sys Upgrade, Ph II - Bldgs 64, 75,79,88	55.0	•	•	•		•	14-Svc Blds	ES&H	10.9													1.0
	SUBTOTAL - PROPOSED MEL-FS PROJECTS									**321.8**	**0.0**	**0.0**	**0.0**	**3.3**	**18.6**	**38.5**	**34.4**	**37.8**	**33.2**	**32.3**	**28.8**	**28.3**	**29.0**
	TOTAL FUND, BUDGT & PROP MEL-FS PROJ									**348.2**	**13.8**	**5.2**	**5.0**	**5.7**	**18.6**	**38.5**	**34.4**	**37.8**	**33.2**	**32.3**	**28.8**	**28.3**	**29.0**

August 1993 escalation rates at 2.6%, FY'93; 3.4%, FY'94; 4.0%, FY'95; 3.9%, FY'96; 3.8%, FY'97; 3.6%, FY'98; 3.7%, FY'99; 3.7%, subsequent years.
Includes an 8.61% Overhead Factor (on TEC). Overhead Factor is subject to change.
*= prior costs from previous Fiscal Years

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Sitewide Programmatic Projects

ALS Beamlines Initiative. This project will provide a second complement of experimental facilities for the ALS, including insertion devices, beamlines, and 1880 gsm (20,200 gsf) of finished light laboratory and office space for ALS users. Located on the second floor of the ALS building, these new facilities will support research in materials and surface science, chemical dynamics, and structural biology.

ALS Structural Biology Support Facilities. Now being constructed, the ALS Structural Biology Support Facilities will occupy a total of 1030 gsm (11,100 gsf) on the second floor of ALS Bldg 6 and the second floor in Building 80, which adjoins Bldg 6. This location provides the Support Facilities with direct access to the ALS experimental facilities for optimum integration of associated research and development activities. The ALS Structural Biology Support Facilities will support life sciences research activities at the ALS, including x-ray microimaging and microholography, x-ray spectroscopy, and x-ray crystallography.

Chemical Dynamics Research Laboratory (CDRL). Located in a new three-story, 4330-gsm (46,600-gsf) building directly adjacent to the ALS, the CDRL will be a state-of-the-art national facility for chemical dynamics research using laser and synchrotron radiation. The laboratory includes an infrared free electron laser (IRFEL), ALS beamlines optimized for chemical sciences research, advanced lasers and molecular beam apparatus, universal particle mass detectors, computer-based modeling systems, and auxiliary instrumentation. The building includes a high-bay heavy laboratory, eight support laboratories and 40 offices.

Elise. Elise will be housed in Building 51B, a part of the Building 51 Bevatron Complex. Building 51B is an open high bay industrial space used as an experimental hall. The conventional facilities portion of this project will construct a weather tight building within Building 51B to house the Elise Accelerator and its associated equipment. The project includes planning, designing and construction to accommodate Elise.

Human Genome Laboratory. The recently funded Human Genome Laboratory will be a 41,000 GSF, three-story building located near the Biomedical Laboratory Bldg 74 and the Cell Culture Laboratory Bldg 83. This state-of-the-art molecular genetics research facility will contain open laboratory areas furnished with modular wet benches and desks. Support facilities including cold rooms, dark rooms, cell tissue rooms, autoclaves and laboratories for robotics, instrumentation and computation will be adjacent to the laboratory areas. Each floor will include a small shared conference room.

Sitewide MEL-FS Projects

Administrative Services Addition - Buildings 50E/F, Second Floor. These second-floor additions to existing one-story wings of Building 50B will provide approximately 1,710 gsm (18,400 gsf) of office area, including 1,160 nsm (12, 500 nsf) of assignable space. The project will consolidate laboratory-wide data communications, computing support and information services, data networking and processing services, technical information services, and administrative and operational management activities. The new additions will also quarter support activities for data intensive scientific programs such as computational seismology, functional imaging and biostatistics; environmental safety and health activities; and administrative and operational applications development.

Buildings 50E and 50F were constructed in 1984-5. They were built to support second-story additions, which will minimize the cost of this project. Both new structures will have steel frames, stucco curtain walls, and two-hour-rated roof construction. Offices will consist of a combination of open space arrangements and some enclosed offices. The offices will have direct access to Building 50B and will use existing rest rooms, stairs, heat and power. Additional parking spaces will be provided. An elevator will be constructed in each of the two units to provide direct access from the parking area under the existing first story.

Administrative Services Facility. This project will create office space for Accounting, Business Management, Data Processing and the CFO, currently located offsite in 3700 gsm (40,000 gsf) of leased space.

Applied Sciences Building. This three-story, 3,720-gsm (40,000-gsf) steel frame building will replace substandard laboratory, office and research facilities for the support of multidisciplinary research. The facility will contain wet and dry laboratories, offices, and computing and calibration facilities. It will replace hazardous and inefficient single story structures that have been maintained significantly beyond their service life. Existing trailers, barracks, wood frame buildings and metal frame World War II structures do not have the electrical, plumbing, ventilation, fire protection and structural systems needed to support research activities according to current standards and operating procedures.

Blackberry Canyon Parking Structure. This open-air braced steel frame structure will have level perimeter parking for 1000 vehicles, with access by an internal parking ramp. Parking will be within walking distance of buildings having the highest population density at Berkeley Lab. Vehicle entrances will be at the first and seventh levels. Pedestrians will use elevators and stairs at the two corners nearest the Buildings 50 and 90 Complexes.

Building 50 Auditorium Expansion. This project will extend the rear of the existing auditorium to provide additional capacity. The entrance will be extended to provide usable space for the lobby. The existing auditorium is too small to meet use demands and requires fire and life safety upgrading.

Building 83 Parking Structure. The major new construction planned for Area 7 (Life Sciences) will increase demand on parking beyond the limits of what is presently available. This project proposes a parking structure of approximately 3250 gsm (35,000 gsf) on a site currently occupied by a grade parking lot with 30 spaces. The maximum 3-story, post-tensioned concrete structure will provide parking for approximately 100 cars and will considerably increase the efficiency of the site.

Building Systems Upgrade, Phase I - Buildings 50, 50B, 90. This project will repair, overhaul and upgrade defective building systems. The defects cause consequential damage which ranges from life-threatening unit failure in the very poorest conditions to safety hazards or sudden disruptions where poor conditions exist. Building components, structural elements, building equipment, special equipment systems and utilities will be upgraded. Evaluation criteria have been established, surveys of building conditions conducted and priorities set. Phase I upgrades address the very poor conditions in Buildings 50, 50B and 90.

Building Systems Upgrade, Phase II - Buildings 64, 75, 79, 88. This project will repair, overhaul and upgrade defective building systems. The defects cause consequential damage which ranges from life threatening unit failure in the very poorest conditions to safety hazards or sudden disruptions where poor conditions exist. The building systems include building components, structural, building equipment, special equipment systems and utilities. Evaluation criteria have been established, surveys of building conditions conducted and priorities set. Phase II upgrades address the very poor conditions which includes buildings 64, 75, 79 and 88.

Building Systems Upgrade, Phase III - Buildings 58, 77. This project will repair, overhaul and upgrade defective building systems. The defects cause consequential damage which ranges from life threatening unit failure in the very poorest conditions to safety hazards or sudden disruptions where poor conditions exist. The building systems include building components, structural, building equipment, special equipment systems and utilities. Evaluation criteria have been established, surveys of building conditions conducted, and priorities set. Phase III upgrades address very poor conditions in Buildings 58 and 77.

Building Systems Upgrade, Phase IV - Buildings 47, 62, 70, 72. This project will repair, overhaul and upgrade defective building systems. The defects cause consequential damage which ranges from life threatening unit failure in the very poorest conditions to safety hazards or sudden disruptions where poor conditions exist. Building components, structural elements, building equipment, special equipment systems and utilities will be upgraded. Evaluation criteria have been established, surveys of building conditions conducted and priorities set. Phase IV

upgrades address very poor conditions in Buildings 47, 62, 70 and 72.

Building Systems Upgrade, Phase V - Buildings 50A, 74. This project will repair, overhaul and upgrade defective building systems. Phase V upgrades address the very poorest conditions, in Buildings 50A and 74. The defects cause consequential damage that ranges from life threatening unit failure in poorest conditions to safety hazards or sudden disruptions where poor conditions exist. The building systems include building components, structural elements, building equipment, special equipment systems, and utilities. Evaluation criteria have been established, surveys of building conditions conducted and priorities set.

Building Systems Upgrade, Phase VI - Buildings 50D, 50E, 55, 71. This project will repair, overhaul and upgrade defective building systems. The defects cause consequential damage that ranges from life threatening unit failure in the very poorest conditions to safety hazards or sudden disruptions where poor conditions exist. The building systems include building components, structural elements, building equipment, special equipment systems, and utilities. Evaluation criteria have been established, surveys of building conditions conducted and priorities set. Phase VI upgrades address poor conditions in Buildings 50D, 50E, 55 and 77.

Child Care Center. This facility, with its adjoining play yard, will accommodate 100 preschool children and will include a kitchen, toilets, and storage rooms in addition to the play and rest areas.

Electrical Systems Rehabilitation, Phase IV - Blackberry Switching Station Replacement. The fourth of six phased upgrades of the Berkeley Lab electrical power system, the Blackberry Switching Station Replacement project will replace the 12kV Blackberry Canyon service area power system, using circuit breakers provided in the FY 1987 improvements to the Grizzly Peak main substation, and correct deficiencies in the Blackberry Canyon service area power distribution system. It will also replace electrical equipment that is old, unreliable, inadequately rated, difficult to maintain and unsafe to operate, allow the retirement of the obsolete Big C switching station, and result in improved operational flexibility, reliability, maintainability and safety.

Electrical Systems Upgrade, Phase V - Central Switching Station and Feeders. This project will upgrade the existing 12kV power distribution system, which services loads distributed throughout the lower part of the Laboratory. It will utilize circuit breakers, provided in the FY 1987 MEL-FS project improvements to the main Grizzly Substation. New installations will include a 12kV switching station near Building 50A, 12kV distribution circuits to Laboratory facilities in the Central Research Area, and a 500 kV substation at Building 55. This is the fifth of six major elements in the master plan to rehabilitate the Laboratory's electrical power system and improve its reliability and safety.

Electrical Systems Upgrade, Phase VI - Upper Blackberry Switching Station. The Upper Blackberry Canyon 12kV Switching Station and Feeders Project is the last major element in the Master Plan to rehabilitate the Laboratory's electrical power system and improve its reliability and safety. It will upgrade the existing 12kV power system and use circuit breakers provided in the FY 1987 MEL-FS project improvements to the main Grizzly Substation. The scope includes installation of a 12kV switching station near Building 71 (HILAC) and 12kV distribution circuits to the Upper Blackberry Canyon area.

Environmental Health and Safety Projects, Phase II. This project will correct 45 improper stormwater sewer connections (37 of which are located under or within buildings), upgrade multiple-room radiation ventilation exhaust systems in Buildings 70 and 88, develop four emergency walking evacuation pathways in support of the Berkeley Lab Emergency Evacuation Plan, and modify natural gas pipelines and stations to minimize damage from seismic activity and improve response time to problem areas.

A new pathway and stairs will connect the Building 62/66/72 area to Centennial Drive. Pathway connections between Horseshoe Curve and the UC stadium/sports field will be improved with the cooperation of the

University. An evacuation stairway will be added to directly connect the Seaborg Stairs near Building 88 with the UC student pathway system. A pathway across the Chicken Creek area will connect the Old-Town and East Canyon areas. The route connecting the Building 71 area with the City streets will receive minor improvements. Each route will minimize distances and conflicts with vehicles.

Environmental Monitoring and Industrial Hygiene (EMIH) Building. The EMIH Building will have three stories with a total of 3000 gsm (32,000 gsf) and 2100 nsm (22,300 nsf) of laboratory and office space. It will be located in Area 5 near Building 75 (National Tritium Labeling Facility), with access from Centennial Drive and Cyclotron Rd. The building will provide offices and laboratory space for Environmental Protection, Occupational Safety, Radiation Assessment, EH&S Planning and Special Projects, EH&S Training, and Division Administration. Facilities will include 1360 gsm (14,650 gsf) of office space, 1390 gsm (15,000 gsf) of laboratory space, 116 gsm (1,250 gsf) of new training facilities and 102 gsm (1,100 gsf) of acid neutralization space.

Facilities Building. The Facilities Building will be a 3-story building with 2,660 gsm (28,600 gsf) and 1,830 nsm (19,700 nsf) of office space. It will be near existing Buildings 75 and 69, with access from Centennial Drive and Cyclotron Road. A utility center of 93 gsm (1,000 gsf) will be constructed nearby in a central utility zone to support the building. The Facilities Building will provide office space for Facilities Planning, Architecture and Engineering, Project Management, Inspection, Maintenance and Operations, physical plant records storage, and Department Administration.

The Facilities Building design meets B-2 occupancy requirements defined in the Uniform Building Code, as well as current seismic standards and fire and life safety codes. It is designed to function following a major earthquake and provide coordinated emergency response activities.

Fire and Safety Systems Upgrade Project, Phase II. The original designs for the many Berkeley Lab buildings that date from the 1940s and 1950s reflected the intended building uses and building codes at the time of construction. Since then major changes have occurred both in codes and building uses. The 1989 DOE Technical Safety Appraisal identified Berkeley Lab facilities that did not comply with code requirements. In 1991 a comprehensive survey of buildings produced a long list of fire and life safety violations. Corrective actions were assigned priorities by the Berkeley Lab Fire Department, and high-priority items were included in the Fire and Safety System Upgrade, Phase I. Phase II will bring additional buildings into compliance with the latest life safety and building codes and standards.

Fire and Safety Systems Upgrade, Phase III. Berkeley Lab facilities were largely built from the 1940s to the mid-1960s. The original designs of buildings were based on the intended occupancies and building codes applicable at the time of construction. Since then major changes have occurred, both in codes and in building uses. The 1989 DOE Technical Safety Appraisal identified Berkeley Lab facilities that were not in compliance with the current code requirements. In 1991 a comprehensive survey of existing buildings produced a long list of fire and life safety violations. The Phase III project will bring further fire and life safety code deficiencies into compliance with the latest life safety and building codes and standards.

Fire and Safety Systems Upgrade, Phase IV. Berkeley Lab facilities were largely built from the 1940s to the mid-1960s. The original designs of buildings were based on the intended occupancies and building codes applicable at the time of construction. Since then major changes have occurred, both in codes and in building uses. The 1989 DOE Technical Safety Appraisal identified Berkeley Lab facilities which were not in compliance with the current code requirements. In 1991 a comprehensive survey of existing buildings identified a long list of fire and life safety violations. The Phase IV project will eliminate remaining fire and life safety code deficiencies.

Hazardous Materials Safeguards, Phase II. Hazardous Materials Safeguards, Phase II, will upgrade buildings 70A and 62 to meet current Uniform Building Code requirements for B-2 laboratory occupancy and additional Berkeley Lab safety standards. The use of hazardous materials in research has

increased significantly in recent years. To address the resulting changes in building codes that apply to Berkeley Labs many old laboratory facilities, a series of projects has been undertaken to provide safety and environmental protection for research involving hazardous materials.

Hazardous Materials Safeguards, Phase III. The use of hazardous materials in research has increased significantly in recent years. To address the resulting changes in building codes that apply to Berkeley Lab's many old laboratory facilities, a series of projects has been undertaken to provide safety and environmental protection for research involving hazardous materials. Hazardous Materials Safeguards, Phase III, will upgrade Buildings 66 and 77 to meet current Uniform Building Code requirements for B-2 laboratory occupancy and additional Berkeley Lab safety standards.

Hazardous Materials Storage and Dispensing Rooms. At present, research at Berkeley Lab uses exempt amounts of hazardous materials. All laboratory buildings operate as B-2 occupancy with control areas as defined in the Uniform Building Code. However, to operate laboratories with exempt amounts, support spaces are needed that are designed to requirements of H-2 and H-3 occupancies for storage and dispensing of larger amounts of hazardous materials. These rooms must be located within convenience of buildings where hazardous materials are used. This project will construct up to seven storage rooms, of maximum (500 gsf), dispersed throughout the Berkeley Lab site. The storage rooms will be of concrete construction and will comply with all code requirements for H-2 and H-3 occupancies.

Incubator Facility. This project will provide highly flexible and adaptable laboratory space for joint ventures between Berkeley Lab and industries and universities to seed startup research activities. Berkeley Lab, industry, and university expertise will collaborate on a short-term basis to establish viable research programs capable of securing independent funding.

Integrated Communications and Computer Support Facility. This 1900 gsm (20,000 gsf) facility will contain a telecommunications cabling plant, centralized computing and mass storage support facilities, a center for wide and local area networking, and the distribution center for local and remote video conferencing. The facility will house all related computer scientists, engineers, hardware and software technicians, and support staff. It will replace the crowded, inefficient and substandard buildings and support utilities now used for Berkeley Lab communications and computer infrastructure. The building will have high-bandwidth wiring to all workstations, a 600-sq-meter (6500-sf) air conditioned computer room, a 930-sq-meter (1000-sf) training room, an antenna facility, and an industrial elevator.

Berkeley Lab Conduit Infrastructure Improvements. Berkeley Lab's conduit infrastructure for the Old Town Area and the Building 75 and 69 area is completely filled, with no room to support the new SSSF, EMIH and Facilities Buildings. The cables feeding these areas come from Building B10A. When the Chemical Dynamics Research Laboratory (CDRL) is built on the B10A site, this project will relocate these cables and telecommunications and networking facilities for the Old Town Area to the Building 80 Basement.

Berkeley Lab Conference and Publication Facility. This project will provide additional space contiguous with the Building 50 Auditorium, supplementing the auditorium with break-out conference rooms, video-conferencing rooms and support facilities. It will also provide offices for the public information function.

Maintenance Building Replacement, Phase I - Building 76. Built in 1964, Building 76, is a two level, 2800 gsm (30,000 gsf) structure housing Maintenance and Operations Group's shops and offices. The structural system does not comply with current building codes. As designed, the structure is expected to withstand seismic forces from a major earthquake without collapse, but with structural and non-structural damage. This project will upgrade structural seismic safety to satisfy the requirement that the shops stay operational during emergencies. In addition, rezoning and additional HVAC and exhaust capacity is required, since the building layout has been incrementally modified over the years so that existing mechanical systems do not fully serve the existing layout and functions. The project will also upgrade thermal insulation to improve energy efficiency and

modify the second level layout for more efficient use of space.

Maintenance Building Replacement, Phase II - Building 78 Addition. Offices located in Building 76 occupy valuable high bay space and are unacceptably overcrowded with 2 to 4 people per office on average. This project will add a 650-gsm (7,000-gsf) second level to Building 78 for offices to relieve this overcrowding. Building 78 was built in 1965. It is a one-story, 520-gsm (5,600 gsf) structure housing craft stores. Since the existing structure does not comply with the current building code requirements for lateral force design, a seismic upgrade will be included in the project. The second floor will be supported by new structural framing independent of the existing structure.

Mechanical Engineering Replacement Building. This project will provide a new, 3-story, 2800 gsm (30,000 gsf) building for the Mechanical Engineering Department. Designed to meet the requirements of current building and life safety codes, the building will house high bay shops, laboratories and offices. It will provide efficiently planned space served by energy efficient mechanical and electrical systems. The exterior finishes will utilize insulated siding and double glazing with low emissivity coating to minimize solar heat gain. The building will replace current facilities in Building 25. Building 25 is an obsolete and inefficient facility whose unsafe structure can't be upgraded to meet minimum standards of seismic safety.

Mechanical Equipment Replacement, Phase I. This project will upgrade aged and deteriorated high priority equipment in building and support mechanical systems throughout Berkeley Lab. It is the first in a series of projects to bring the Laboratory's mechanical equipment systems up to modern industrial standards for safe and efficient operation. Cooling towers, heating hot water boilers, steam boilers, air compressors, water chillers, an emergency generator, natural gas seismic safety valves and ancillary piping and control systems will be replaced.

Mechanical Equipment Replacement, Phase II. This project will upgrade aged and deteriorated equipment, not covered in Phase I, in building and support mechanical systems throughout Berkeley Lab. It is the second in a series of projects to bring the Laboratory's mechanical equipment systems up to modern industrial standards for safe and efficient operation. Cooling towers, heating hot water boilers, steam boilers, air compressors, water chillers, an emergency generator, natural gas seismic safety valves and ancillary piping and control systems will be replaced.

Mechanical Utilities Upgrade, Phase II. This Phase II project will replace and extend the mechanical utility corridor into the East Canyon Area and add a 1136-cubic-meter (300,000-gal) water storage tank above the Buildings 74/83 Complex for fire protection. Most utility systems at Berkeley Lab were constructed to meet the requirements of both institutional needs and research programs. Funds often have not been available to install systems having extra capacity or provisions for future expansion.

Mechanical Utilities Upgrade, Phase III. The work proposed under Phase III will rehabilitate deteriorated and aged utilities, and replace and extend major east and west mechanical utilities near the Original Laboratory Site. Most utility systems at Berkeley Lab were constructed to meet the requirements of both institutional needs and research programs. Funds often have not been available to install systems having extra capacity or provisions for future expansion.

Mechanical Utilities Upgrade, Phase IV. The work proposed under Phase IV will rehabilitate deteriorated and aged utilities sitewide.

Mechanical Utilities Upgrade, Phase V. The work proposed under Phase V will rehabilitate deteriorated and aged utilities, add compressed air facilities at Building 70 and restore portions of the sanitary sewers.

Mechanical Utilities Upgrade, Phase VI. The work proposed under Phase VI will replace approximately 20 percent of utilities every ten years (50 years average age at replacement).

Medical Services Asbestos Abatement and Rehabilitation. This project will upgrade the Medical Services Building (Building 26) HVAC system, replace the lighting system, remove and replace asbestos-containing ceilings and siding, install utilities and finish ceilings, walls and floors in existing unfinished space on the first floor, provide handicapped

access and refuge, and replace part of the roof.

Existing ventilating equipment will be removed and replaced with new rooftop air conditioning units, ductwork, registers and controls. A new 1000 gsm (10,800 gsf) ceiling will be installed, necessitated by HVAC removal work on the lower floor and by removal of 335 gsm (3,600 gsf) of asbestos-containing ceiling tile on the upper floor. The 20 year old lighting system will also be replaced. Exterior building panels containing asbestos will be removed and disposed of. Other asbestos-containing material will be properly contained and managed.

Improvements to existing unfinished space will be constructed on an existing foundation adjacent to Building 26. The work will include a new concrete slab, ceiling, walls, air conditioning, and lighting systems, and will result in 130 gsm (1,400 gsf) of new office space. As required by state regulations, the entry and restrooms on the lower level will be made handicapped-accessible, and an emergency refuge accessible to the handicapped will be provided. A two-story hydraulic elevator will be added and emergency egress violations on the lower level corrected.

Old Town Parking Structure. This maximum 3-story, post-tensioned concrete, 3250-gsm (35,000-gsf) parking structure in the Old Town area will be accessible from Upper Hill Road. It will hold approximately 100 cars and utilize existing topography to maximize grade access. The parking shortage at Berkeley Lab is most pronounced in the Old Town area, where some roads and vehicular accessways are substandard. With the ALS (Building 6) coming on line in 1993, this shortage will become more acute.

Pedestrian Circulation System. This project will provide designated pedestrian routes, forming a comprehensive sitewide circulation system that will connect buildings, population centers, destinations, parking areas and outdoor use spaces. The system will consist of a central primary system connecting building 50 to building 90 and building 69 that will carry the most traffic, a connected secondary system carrying less traffic between buildings, parking areas and outdoor use areas, and a tertiary system for light traffic access to cul-de-sac functions.

Unsafe situations currently exist, with no pedestrian routes, discontinuous sidewalks or designated routes, indirect routes, and routes with insufficient capacity. The proposed system will supplement and upgrade existing routes and provide new routes where none exist.

Roadway Safety and Stabilization, Phase I. This project will modify and upgrade sections of the Berkeley Lab roadway system, improving pedestrian and vehicular safety and stabilizing adjacent landslides, which have the potential to displace roadways and integral underground utilities. Improvements will include wider lanes, longer turning radii, increased sight distances, and separation of pedestrian and vehicular traffic. Improved structural subgrade and pavement sections will allow the system to handle modern highway loadings and reduce maintenance. Construction scope includes demolition and removal of existing roadways and appurtenances, earthwork and grading, drainage works, utility relocation, construction of new roadway and related structures, and landscaping. Project areas include Cyclotron Road from Hearst Avenue to Building 65, the Grizzly Gate entrance, the Building 71/ Upperhill Road intersection, Bevatron Circle Curve, and Cyclotron Road near Building 31.

Roadway Safety and Stabilization, Phase II. This project will widen Cyclotron Road from Building 54 to Building 66 for two-way traffic and a pedestrian sidewalk, realign intersections near Buildings 48 and 72, improve stopping sight distance on horizontal and vertical curves along Cyclotron Road, and stabilize a creep slide near Building 48. Currently, traffic going to the eastern end of the Lab must pass through a narrow and busy alley between Buildings 77 and 77A. Besides creating a pedestrian and vehicular hazard, this slower and longer route leads to a loss of productivity. Cyclotron Road is a much more direct route and better isolated from heavily populated areas of the Lab.

Roadway Safety and Stabilization, Phase III. This project will widen Sally's Alley to two full traffic lanes and a sidewalk. The road is currently designated "one lane, two direction," requiring vehicles to take turns going through the alley. The project will also

realign the road behind Building 71 and repair the adjacent slide area. Other miscellaneous road improvements and slide repairs scattered around the Lab are included in this project.

Roof Replacements, Phase II. This project will replace roofs that need replacement the most, reconstruct platforms for rooftop-mounted mechanical equipment, and consolidate and replace equipment. Priorities will include safety hazards, equipment protection, high maintenance costs and time of essence replacements.

Berkeley Lab buildings are on average 35 years old, with some dating from 1940. Most roofs have exceeded their 10-to-20-year lifetimes. Old roofs result in excessive maintenance for buildings and equipment and disruption of research programs. Costly patching and overlays have become ineffective in preventing leaks. Only complete replacement down to the underlying structural supports can restore reliability and cost-effective maintainability.

Roof Replacements, Phase III. This project will continue the work of Phase II in replacing roofs that most need replacement , reconstructing platforms for rooftop-mounted mechanical equipment, and consolidating and replacing equipment. Priorities will include safety hazards, equipment protection, high maintenance costs and time of essence replacements.

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Safety and Support Services Facility (SSSF). A three-story building of 2390 gsm (25,750 gsf) and 3050 nsm (32,800 nsf), the SSSF will replace a portion of the Building 69 complex (Materials Management, Purchasing, Mailroom), connecting with and providing vertical circulation and public facilities for the remaining Building 69 wing. A hydraulic passenger elevator will serve each floor. A utility building will be located at the end of Building 69 to provide heat and cooling for the SSSF. Utilities, available at the site, will be modified or extended to fit facility requirements. Total occupancy will be 94 persons. Access will be from Centennial Drive and Cyclotron Road.

The SSSF will have a rigid structural steel frame and exterior walls of preformed metal siding. The foundation will be a concrete slab-on-grade on spread footings and friction piles. The roof will be composed of rigid insulation over metal decking, covered with a 3-ply modified bitumen roofing system. The sprinkler system will be connected to the Berkeley Lab fire alarm system. Office space will be furnished with relocated open-plan modular furniture and partition systems.

Sanitary Sewer Restoration, Phase I. This project will replace sections of 3-inch to 8-inch sanitary sewer lines showing signs of imminent leakage or failure, as determined by a video survey of 1060 m (3,480 ft) of line. Additional video surveys are planned for the balance of the sanitary sewer system. During construction, soil samples will be tested by a certified laboratory for contamination. Contaminated excavated material will be either remediated or removed to an authorized hazardous waste site.

Science Education and Reception Center. Containing administrative offices, displays,

and conference and training rooms, this 1,400-gsm (15,000-gsf) multistory steel frame building will be the center for administrative and research support functions directly related to the public and Berkeley Lab's employment and training programs. Currently, these functions are dispersed, are in temporary trailers, or are off-site. The new facility will support DOE administrative and programmatic requirements for human resources, public information, work-for-others administration, training, and orientation. Berkeley Lab units quartered in this facility will include the Center for Science and Engineering Education, Technology Transfer Department and Office of Sponsored Research Administration, Public Information Department, Badge Office, Shuttle Bus Services, Employment, and the Training and Orientation Program. Video facilities and educational outreach offices for specific R&D programs and demonstration space for education programs are included.

Seismic Rehabilitation Project. This project will strengthen and modify structures, equipment and nonstructural elements sitewide to reduce damage if a major seismic event occurs. The majority of Berkeley Lab facilities were designed when the Uniform Building Code did not reflect the greater seismic forces currently anticipated on the nearby Hayward Fault.

Site Electrical Equipment Replacement, Phase I. This project will upgrade many old, obsolete and hazardous items of electrical equipment that were not part of the master plan to rehabilitate the Laboratory's 12kV electrical distribution system. This equipment is located primarily in electrical substations and building equipment rooms and includes aged, PCB -filled, power factor correction capacitor banks; insufficiently rated 12kV circuit breakers at Building 51; aged and insufficiently rated main distribution equipment and motor control centers in the older laboratory buildings; the transformers and secondary distribution equipment at Building 16 and Building 70A; and obsolete standby power generators at the older laboratory buildings, which cannot comply with the latest safety codes for emergency generators.

Sitewide Electrical Equipment Replacement, Phase II. This project will correct remaining deficiencies in the power distribution systems of a number of the Laboratory's buildings. The improvements will replace old electrical systems containing old, unreliable and inadequately rated equipment that is difficult to maintain and, in some cases, unsafe to operate. In many instances, the equipment is 20 to 30 years old. Many of the older distribution panels contain circuit breakers that do not have adequate fault interrupting capability, and the older standby engine-generators do not meet all OSHA and NEPA safety requirements.

Technology Transfer Building. This facility will provide offices, conference areas, and an integrated communication center for sponsored research, technology transfer and Berkeley Lab counsel.

Upgrade of Berkeley Lab Communications System. New Government regulations require Berkeley Lab to replace all of its radios with spectrum efficient models. Starting in 1995, new radio purchases must meet the regulations on spectrum efficiency, and all radios must comply by 2005. This gives Berkeley Lab the opportunity to replace its VHF radio system with a UHF trunking radio system that meets these new standards. A trunked radio system will provide improved coverage to the Laboratory, allowing transmissions to be clearly heard from any part of the Laboratory. The current VHF simplex system provides inadequate coverage and impairs safety-related operations such as high voltage switching, Fire Department and building manager communications. Trunking will allow assignment of individual talk groups, which give users a virtually private channel. A trunking system can handle several thousand talk groups without additional radio spectrum, ensuring future expansion needs. Because VHF and UHF radios are not compatible, the UHF Trunking System must be made operational before any users can switch to it from the old system. This system must be installed before all available frequencies are allocated.

Upgrade of Site Mechanical Utilities, Phase II—Sewer Monitoring. This project includes construction of the East Canyon utility center, East Canyon sanitary sewer modifications, East and West Canyon sanitary sewer monitoring facilities, and miscellaneous site utilities. The East Canyon utility center will

provide cooling water and compressed air to the Life Sciences Research Area (Area 7) and compressed air to other building areas in the East Canyon. The design will be modular, with space to expand the cooling water systems for future buildings in Area 7. After modification, the East Canyon sanitary sewer system will gather all Berkeley Lab waste into one outfall and keep it separate from UC Berkeley waste. The new monitoring facilities will be located at the West Canyon and East Canyon sanitary sewer outfalls. Miscellaneous utilities will include cathodic corrosion protection for buried cooling water and compressed air lines, a storm drain system for Building 52 (Magnetic Fusion Energy Laboratory), and double-wall tanks with leak monitoring that will replace buried tanks removed as part of the project.

GENERAL PLANT PROJECTS

GPP funds have been provided by DOE. Funding to date has been inadequate to meet the Laboratory needs in a timely schedule. This program has a significant backlog of projects, approximately$30 M. Roughly one-quarter of this backlog is for environment, health, and safety needs and one-half is for general improvements and replacements. Increasing GPP funding to $6 M annually would ensure the success of the Laboratory's safety rehabilitation program and help reduce the current backlog of projects over the next five years.

GENERAL PURPOSE EQUIPMENT

Essential support equipment has been funded through DOE. Berkeley Lab's Five-Year GPE Plan identifies needs based on a range of criteria, including environment, safety, and health; legal requirements; failed, worn, inefficient, or obsolete equipment; substandard performance; or increased workload and demand. The current funding level of $1.7 M/year is minimally adequate to meet the Laboratory needs. Currently there is a $19 M equipment backlog for environmental monitoring and fire safety, physical-plant, transportation, and data processing and communications. Consolidated GPE management at the level of the OER facilitates the implementation of an integrated and longer-range GPE plan.

IN-HOUSE ENERGY MANAGEMENT

Berkeley Lab has successfully applied IHEM funding to reduce energy consumption and costs. New buildings are designed with energy-efficient components, and existing buildings are being systematically retrofitted. Progress toward the DOE goals for energy consumption reduction based on 1985 levels is as follows:

- A 19.7% reduction in building electricity consumption per sq ft, which exceeds the year 1995 goal of a 10% reduction.
- A 36.6% reduction in metered process electricity consumption per sq ft, which exceeds the year 2000 goal of a 25% reduction.
- A 14.2% reduction in natural gas consumption per sq ft, which meets the year 1995 goal of a 10% reduction.
- A 0.1% increase in vehicle fuel consumption, compared to the 1995 goal of a 10% reduction.

The IHEM Programs efforts to complete studies and retrofits will continue to find energy efficiency opportunities and reduce the consumption of energy.

MAINTENANCE PLANS

Maintenance plans and budgets are developed annually within an overall five-year planning and safety management strategy. The Laboratory has improved its current maintenance scheduling system and backlog of maintenance projects through implementation of the sitewide Plant Inspection Program, which will be superseded soon by the Condition Assessment Survey (CAS) program. These include noncapital alterations, general plant projects, and multiprogram general-purpose

line items. Requirements are identified by periodic reviews and inspections, and new priorities are developed during the fiscal year.

The operating expenses for maintenance include physical-plant maintenance, mobile-equipment maintenance, and noncapital alterations related to maintenance. In addition, specialized maintenance related to shop, computer, and telecommunications facilities is also performed.

The current strategy for improving maintenance relies on strengthening the capital outlays, continuing the operating-costs efforts, and implementing the maintenance planning system. This allows the Laboratory to sustain DOE facilities while planning for maintenance-cost economies. These economies can be achieved through the replacement of existing obsolete and high-maintenance-cost facilities with modern facilities and equipment supported by increased MEL-FS, operating, and GPE funds. Operating funds to replace infrastructure equipment are a particularly pressing need, because recent revisions to the GPE criteria have eliminated the GPE funding option in this area.

SITE MAINTENANCE PLAN

The Berkeley Lab Maintenance Policy outlines the basis for maintenance of all laboratory property as required by DOE. Maintenance is defined as the predictive, preventive, and corrective activities required to keep facilities and equipment in a condition suitable for the intended use.

The Berkeley Lab Facilities Department is responsible for the maintenance of real property and installed equipment. This maintenance includes operation, caretaking, restoration, and replacement of the physical plant grounds and exterior facilities, utilities, buildings, and building equipment, as well as of the tools, equipment, and information systems directly supporting these activities. Fixed and portable research apparatus and supporting tools, instruments, and equipment are not included. Maintenance operations are based on the graded approach.

The distribution of effort for the Facilities Department, Maintenance & Operations Group work force includes approximately 185 FTE's across the administrative, technical, engineering and support for programmatic disciplines.

Maintenance related activities may be funded from internal overhead, General Plant Equipment (GPE), General Plant Projects (GPP), Multi-Program Energy Laboratory-Facilities Support (MEL-FS), or Environmental Restoration and Waste Management (ERWM) funds. Internal overhead expense moneys fund the day to day caretaking activities that extend facilities usefulness within and beyond the original design's life expectancy.

The total maintenance expense budget for FY94 is $5.7M.

Activities which may support maintenance are also included as identified projects among GPE, GPP, MEL-FS, and ERWM budget proposals. These activities typically involve the replacement, renewal, renovation, or upgrade of an existing plant facility component that is considered capital property. The criteria for each particular potential capital funding source is used as a profile as each identified deficiency is categorized. These capital funding sources may also cover projects that are modifications and additions to the physical plant intended to change the capacity or capability of function. Project proposals for these capital areas usually cover several years, from concept definition to project completion. Some maintenance related projects are scheduled into out-years.

The Maintenance budget development process runs throughout the year, and includes condition assessment, formulation of corrective action plans, reviews of the effectiveness of existing practices and programs, and adjustments due to changes in the DOE orders and various laws and regulations. Table 5-6 indicates overall Facilities Maintenance funding levels needed.

Maintenance backlog is defined as the amount of maintenance and repair work not accomplished that is needed to sustain the assigned mission. In accordance with this definition a complete review and scrutiny of the backlog list was completed and resulted in a current backlog figure of $23,351K. This is considered the "Base Maintenance Backlog" for Performance Indicator evaluations.

Table 5-6. Facility Maintenance Funding Levels ($K)

FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000
5,703	6,515	7,273	7,467	7,666	7,871	8,080

Table 5-7. Maintenance Backlog Projects and Other Maintenance Funded for FY 1994 ($M)

	No. of Projects	Cost
MEL-FS	1	2.95
GPP	9	3.22
Funded Backlog Projects	4	0.36
Total	4	6.53

Maintenance backlog projects funded for FY1994 and projects funded from other sources for FY1994 are given in Table 5-7.

Several performance indicators in the areas of facility condition, preventive maintenance, occurrence reports, maintenance projects backlog management, and Appendix 'E' milestones have been developed.

INFORMATION RESOURCES MANAGEMENT

The foundation of the Berkeley Lab long-range computing strategy is the development and operation of a distributed computing network offering access to a large-scale, interactive, high-speed computing resource, shared archival mass storage, satellite computers, and workstations. The internal Berkeley Lab computer network (LBLnet) is supplemented by national and international networks. The specific components of Berkeley Lab's distributed network are listed below.

- Access to a broad range of computing platforms, storage devices and network facilities
- Powerful computing processor cluster, stoage, and networking facilities

- Desktop systems for all professional and administrative staff
- Access to OER supercomputer centers at Lawrence Livermore National Laboratory and Florida State University
- An onsite integrated communications system (ICS) for voice and data switching
- A radiocommunications system for service and emergency functions

Berkeley Lab's information resources management (IRM) strategy includes focused support for improving the nation's computing and communications infrastructure, assistance to DOE in the development of IRM policies and plans, and development of Berkeley Lab's computing and communications infrastructure to support the Berkeley Lab/DOE multiprogram energy research laboratory mission. Berkeley Lab's external strategies include enhancing the Berkeley Lab work environment and corporate information and providing quality and timely information and records. Resources and initiatives to support these strategies include advanced high-speed networking, computing upgrade, visualization, video, technical information, and other initiatives and infrastructure investments.

APPENDIX A

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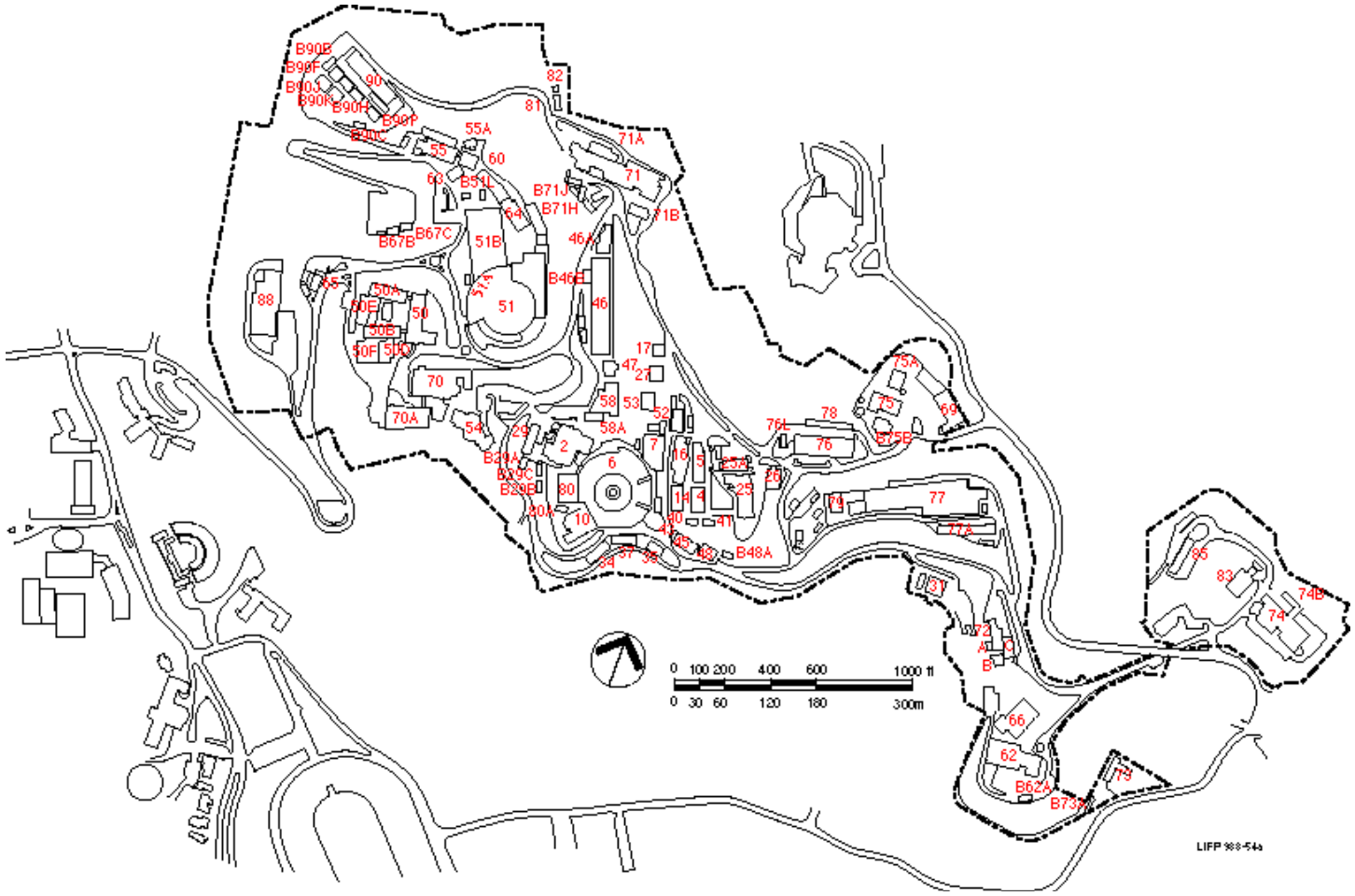
APPENDIX B BERKELEY LAB MAP WITH BUILDING NUMBERS

(See Appendix C for Building Descriptions)



Berkeley Lab map with building numbers (DRAFT)

BERKELEY **L**AB **O**FF-**S**ITE **B**UILDING **N**UMBERS

Building Number	Building Name/Description
Off-Site Leased Buildings	
901	Receiving/Warehouse — 1450 64th St., Emeryville
901A	Used Furniture; Excess Material — 1450 64th St., Emeryville
934	DYMO Bldg: Printing Plant, Cell & Molecular Biology — 91 Bolivar Dr., Berkeley
936	CFO and OSRA — 2070 Allston Way, Berkeley
938	Promenade: Information Systems and Services, Human Resources
Campus Buildings Assigned Berkeley Lab Numbers	
1	Donner Laboratory
3	Melvin Calvin Laboratory
B3A	Trailer (on roof of 3)
3B	Modular Bldg. (on roof of 3)
8	Hearst Mining
11	Hildebrand Hall
18	Gilman Hall
19	LeConte Hall
19A	Birge Hall
20	Life Sciences Building
21	Giauque Hall
22	Latimer Hall
24	Etcheverry Hall
38	Lewis Hall
39	Cory Hall
57	Cowell Hospital — Donner Pavilion
905	Hesse Hall
921	Stanley Hall
926	Morgan Hall
029	Haviland Hall
952	Moses Hall
953	Earth Sciences
983	Wurster Hall
984	Davis Hall
985	Garage
986	Harmon Gym
987	Warren Hall
988	Boalt Hall
989	Lawrence Hall of Science
990	Evans Hall
991	T-4 (Energy & Resources Program)
992	Tolman
993	T-9 (University-Wide Energy Research Group)
994	McLaughlin Hall
995	Baker Hall
996	Campbell Hall
997	Minor Hall
998	Silver Laboratory (Space Sciences Lab)
999	Mathematical Sciences Research Institute
Richmond Field Station Building Numbers	
911–177	Radon Research House
911-180	Indoor Air Quality Laboratory
911–198	Earth Sciences Laboratory

APPENDIX C 1994 LBNL BUILDINGS AND REHABILITATION STATUS

Building Number	Building Name Description	Functional Unit (c)	Area gsm	Area gsf	Persons	Condition/ Rehab Status (a)	Life Data	
							Age	Dsgn
HILL-SITE BUILDINGS								
Area 1 — 88-Inch Cyclotron Research Area								
B-13A	Environmental Monitoring Station, West of Bldg. 88	–	7	76	0	1	–	–
B-13E	Environmental Monitoring Station, SW of Bldg. 88	–	6	68	0	1	–	–
B-33B	Blackberry Canyon Gatehouse	–	9	97	0	3	28	–
88	88-Inch Cyclotron, Nuclear Science	16	4,849	52,189	58	1	33	50
B-88A	Storage	–	32	342	0	1	14	–
B-88B	Compressor Shelter & Storage	12	50	534	0	1	–	50
B-88C	Flammable Gas/Liquid Storage	–	7	80	0	3	–	–
B-88D	Emergency Generator Building	–	25	265	0	1	14	–
		Total(b)	**4,985**	**53,651**	**58**			
Area 2 — Central Research and Administration Area								
B-13B	Environmental Monitoring Station, West of Bldg. 90	–	7	76	0	1	–	–
B-13G	Environmental Monitoring Station, West of 70	–	13	140	0	1	–	–
50	Physics, AFR and Berkeley Lab Library, Auditorium	15	4,397	47,324	153	2	50	50
50A	Director's Offc, Plan'g & Dvlpmt, Admin Div, Patents, Lab Counsel	10	6,303	67,845	202	2	31	50
50B	Physics, Telephone Services, ICSD, Computer Ctr	15	5,945	63,991	200	2	26	50
50C	Public Information Department (PID)	10	271	2,916	13	1	13	10
50D	Nuclear Science & MCSD	10	465	5,010	36	1	14	25
50E	Earth Sciences	10	943	10,150	67	1	9	50
50F	Information Resources, Computing Services	10	771	8,300	45	1	8	50
54	Cafeteria	10	1,097	11,806	8	2	43	50
54 Addn*	Cafeteria Addition	–	204	2,200	–	1	–	–
B-54A	Wells Fargo Express Service	–	18	195	0	1	11	–
55	Research Medicine & Radiation Biophysics (RMRB)	15	1,721	18,528	67	1	42	50
55A	Nuclear Magnetic Resonance (NMR)	15	143	1,535	5	1	8	25

Building Number	Building Name Description	Functional Unit (c)	Area gsm	Area gsf	Persons	Condition/ Rehab Status (a)	Life Data	
							Age	Dsgn
B-55A	Office Trailer	10	48	517	5	3	15	10
B-55B	Emergency Generator	–	19	209	0	1	6	–
65	Reception Center	10	320	3,443	0	2	41	25
B-65A	Community Relations, Shuttle Buses	10	136	1,459	26	3	9	10
B-65B	Public Information Department	10	95	1,020	8	3	10	10
B-67B	Office Trailer	10	110	1,189	4	3	15	10
B-67C	Laboratory Trailer	15	110	1,189	2	3	15	10
B-67D	Mobile Infiltration Test Unit	–	12	129	0	3	–	–
B-67E	Laboratory Trailer	–	27	290	0	3	21	–
70	Nuclear Science, Applied Science, & Earth Sciences	15	5,800	62,432	232	2	38	50
70A	Nuclear Sci, Chemical Sci, Earth Sci, Cell & Molecular Biology	15	6,257	67,355	189	2	32	50
B-70A	Storage	–	16	173	0	1	6	–
B-70B	Telephone Terminal	–	35	382	0	1	14	–
B-70C	Storage Container	–	14	156	0	1	–	–
B-70D	Storage Container	–	15	160	0	1	–	–
B-70E	Storage Container	–	40	432	0	1	–	–
90	Energy & Env, Employment, Engineering, Personnel, Protective Serv	10	8,203	88,301	377	2	33	50
B-90B	Plant Engineering	10	134	1,440	7	3	16	10
B-90C	Plant Engineering	10	110	1,183	8	3	16	10
B-90D	UC Auditors	10	18	192	4	3	16	10
B-90E	UC Auditors	10	17	188	0	3	16	10
B-90F	Plant Engineering	10	218	2,343	12	3	14	10
B-90G	Plant Engineering Department	10	172	1,847	8	3	15	10
B-90H	Plant Engineering	10	171	1,846	16	3	15	10
B-90J	Plant Engineering	10	264	2,840	17	3	15	10
B-90K	Plant Engineering	10	268	2,882	14	3	15	10
B-90P	Office Trailer	10	198	2,130	0	3	14	10
B-90Q	Rest Room Trailer	–	39	425	0	3	15	–
B-90R	Telephone Vault	–	15	160	0	3	15	–
		Total(b)	**45,179**	**486,328**	**1,725**			
Area 3 — Bevalac Accelerator Complex								
B-13D	Environmental Monitoring (B7IN)	–	7	76	0	1	–	–
46	Accelerator Electronics Dept, ALS	15	4,847	52,168	151	2	44	50
46A	Computer Systems Engineering Dept	15	511	5,504	35	1	16	25

Building Number	Building Name Description	Functional Unit (c)	Area gsm	Area gsf	Persons	Condition/ Rehab Status (a)	Life Data	
							Age	Dsgn
B-46B	EE Office Trailer	10	117	1,260	6	3	14	10
B-46C	Mech Eng Office Trailer	10	95	1,024	5	3	16	10
B-46D	AFR, Mech Eng Office Trailer	10	73	786	4	3	9	10
47	Advanced Accelerator Study	15	581	6,258	28	3	36	50
51	Bevalac/Bevatron	16	8,114	87,335	60	2	43	50
51A	Bevatron Experimental Area	16	2,313	24,894	0	2	35	50
51B	External Particle Beam (EPB) Hall	16	3,614	38,906	0	1	31	50
B-51B	Small Trailer	10	284	3,057	0	3	–	10
B-51C	Bevatron Plumbers Storage	–	38	406	0	1	–	–
B-51D	Bevatron Electricians Shop	14	48	512	5	1	15	20
B-51E	Bevatron Electrical Storage	–	46	496	0	1	15	20
B-51F	HISS Building	15	143	1,543	0	3	14	10
B-51G	HISS Building	15	117	1,263	0	3	14	10
B-51H	HISS Building	15	145	1,556	2	3	14	10
B-51L	VAX User Facility	10	80	864	0	1	8	10
B-51M	Bevatron Trailer	15	52	560	0	3	10	10
B-51N	Bevalac Patient Facility	15	59	640	4	1	–	20
56	Cryogenic Facility	14	89	961	0	2	17	25
56 Addn*	Biomedical Isotope Facility	–	97	1,039	–	1	–	–
58	Heavy Ion Fusion (HIF)	15	927	9,979	18	3	43	50
58A	Accelerator Research & Development Addition	15	1,076	11,586	0	1	24	50
60	High Bay Laboratory	15	316	3,400	0	1	14	50
63	Accelerator & Fusion Research	15	244	2,624	4	3	16	20
64	Accelerator & Fusion Research	15	2,199	23,667	41	2	42	50
B-64A	Bevatron Riggers	10	48	515	1	3	25	10
71	Heavy Ion Linear Accelerator (HILAC)	16	5,558	59,825	62	1	37	50
71A	HILAC Rectifier	–	376	4,047	0	1	30	–
71B	HILAC Annex	16	644	6,693	15	1	37	50
B-71B	Office Trailer	10	47	511	4	3	12	10
B-71C	Office Trailer	10	55	593	3	3	25	10
B-71D	Office Trailer	10	47	511	2	3	23	10
B-71E	Office Trailer	10	47	511	0	3	20	10
B-71F	Office Trailer	10	47	511	2	3	19	10
B-71G	Office Trailer	10	47	511	0	3	19	10
B-71H	Electronics Engineering Department Office	10	132	1,416	7	3	19	10

Building Number	Building Name Description	Functional Unit (c)	Area gsm	Area gsf	Persons	Condition/ Rehab Status (a)	Life Data	
							Age	Dsgn
B-71J	Office Trailer (DOE/SF Site Office)	10	115	1,239	5	3	15	10
B-71K	Office Trailer	10	45	484	1	3	14	10
81	Liquid Gas Storage	14	104	1,124	0	1	25	20
82	Lower Pump House	–	47	503	0	1	12	–
		Total(b)	**33,591**	**361,358**	**465**			
Area 4 — Light Source Research and Engineering Area								
2	Advanced Materials Laboratory (AML), Center for X-Ray Optics (CXRO)	15	7,973	85,820	157	2	5	50
4	Magnetic Fusion Energy (MFE)	15	942	10,137	42	3	449	25
B-4A	Safety Equipment Storage	–	12	133	0	3	19	–
5	Magnetic Fusion Energy (MFE)	15	664	7,149	12	3	51	50
B-5A	Mechanical Storage	–	15	160	0	3	–	–
B-5B	Electrical Storage	–	15	160	0	3	–	–
6	Advanced Light Source (ALS - under construction	16	10,891	117,228	0	1	2	50
7	Central Stores & Electronics Shops	12	2,022	21,760	54	3	50	25
B-7A	Radio Shop	–	11	120	0	3	19	–
B-7B	Inventory Management	10	44	473	2	3	16	10
B-7C	Materiel Management	10	44	473	1	3	16	10
B-7E	Office Trailer	–	97	1,040	0	3	16	–
10	ALS and Photography	15	1,475	15,873	25	3	49	25
B-10A	Utility Building	–	22	242	0	3	–	–
B-13C	Environmental Monitoring Station, South of Strawberry Clubhouse	–	7	76	0	1	–	–
B-13F	Environmental Monitoring Station, North of Strawberry Clubhouse	–	3	36	0	1	28	–
B-13H	Radiation Monitoring Station, Southeast of Bldg. 37	–	8	90	0	3	–	–
14	Accelerator and Fusion Research (AFR) and Earth Sciences	15	390	4,200	16	3	49	25
16	Magnetic Fusion Energy Laboratory	15	1,049	11,288	16	3	50	50
B-16A	Power Supply House	–	31	339	0	3	33	–
17	Environmental Health and Safety (EH&S)	15	192	2,065	5	3	44	50
B-17A	ALS Test Facility	–	16	174	0	3	–	–
25	Mechanical Technology	14	1,869	20,113	93	3	46	50
25A	Electronics Shop	14	681	7,335	2	2	30	50
B-25B	Waste Treatment	–	26	275	0	3	–	–

Building Number	Building Name Description	Functional Unit (c)	Area gsm	Area gsf	Persons	Condition/ Rehab Status (a)	Life Data	
							Age	Dsgn
26	Health Services	14	1,034	11,129	34	2	29	50
26 Addn*	EH&S	–	288	3,100	–	1	–	–
27	Cable Shop & High Voltage Test Facility	15	305	3,288	1	3	45	50
29	Electronics Instru Dept, Res Medicine & Radiation Biophysics (RMRB)	10	957	10,298	30	3	46	25
B-29A	Electronics Engineering, Computer Sciences	10	155	1,673	9	3	15	10
B-29B	Electronics Drafting	10	132	1,420	10	3	15	10
B-29C	Energy & Environment	10	119	1,282	9	3	15	10
B-29D	Rest Room Trailer	–	26	283	0	3	15	–
37	Utilities Service	29	537	5,784	0	1	6	50
40	Electronics Development Laboratory	15	88	952	4	3	46	25
41	Magnetic Measurements Laboratory	15	92	995	5	3	45	25
43	Compressor Building	–	94	1,007	0	1	54	–
44	Indoor Air Pollution Studies	15	74	800	1	3	37	25
B-44A	Plant Engineering Inspectors	10	45	480	5	3	14	10
B-44B	Energy & Environment	10	134	1,439	6	3	14	10
45	Fire Apparatus	14	305	3,278	0	1	23	50
B-45A	Smoke House	–	12	128	0	3	–	–
48	Fire Station	14	392	4,221	26	1	12	50
48 Addn*	Fire Station Addition	–	158	1,700	–	1	–	–
B-48A	Fire Station Storage	–	30	320	0	3	15	–
52	Magnetic Fusion Energy Laboratory	15	608	6,542	2	3	50	50
B-52A	MG House	–	48	516	0	3	32	–
B-52B	Magnetic Fusion	10	110	1,180	5	3	14	10
53	SuperHILAC Development, Magnetic Fusion Energy	15	597	6,426	4	3	44	50
B-53A	Gardener's Storage	–	18	192	0	3	28	–
B-53B	Office Trailer	10	47	511	3	3	21	10
80	Electronics Engineering, Accelerator & Fusion Res	–	2,459	26,471	48	2	39	–
80A	Electronics Installation & Fabrication	14	88	947	6	1	16	10
		Total(b)	**37,451**	**403,121**	**633**			
Area 5 — Shop and Support Facilities Area								
31	Chicken Creek Maintenance Building	14	563	6,060	14	1	7	NA
B-31A	Earth Sciences	10	58	624	0	3	–	10
B-33C	Grizzly Peak Gatehouse	–	7	80	0	1	28	–

Building Number	Building Name Description	Functional Unit (c)	Area gsm	Area gsf	Persons	Condition/ Rehab Status (a)	Life Data	
							Age	Dsgn
36	Grizzly Substation Switchgear Building	14	84	901	0	1	2	50
42	Salvage	14	113	1,215	2	3	51	20
B-42A	Emergency Generator House	–	14	156	0	3	–	–
61	Standby Propane Plant	–	30	323	0	1	24	–
68	Upper Pump House	–	46	500	0	1	14	–
69	Material Management, Purchasing, Mailroom	10	1,613	17,360	60	1	26	50
75	Radioisotope Service, National Tritium Facility (NTF)	15	824	8,869	23	1	31	50
75A	Compactor, Processing, and Storage Facility	12	378	4,064	0	3	14	10
B-75B	Office Trailer, EH&S	15	443	4,771	27	3	14	10
B-75C	Calibration Range	–	42	450	0	3	–	–
B-75D	Waste Storage	12	96	1,035	0	3	15	10
B-75E	Office Trailer (Tritium Group)	15	38	410	0	3	3	10
B-75F	Hazardous Storage Shed	–	19	207	0	3	–	–
B-75G	Hazardous Storage Shed	–	7	72	0	3	–	–
B-75H	Hazardous Waste Compaction	–	7	72	0	3	–	–
B-75J	Hazardous Waste Compaction	–	46	494	0	3	–	–
B-75K	Hazardous Waste Storage	–	7	72	0	3	–	–
B-75L	Hazardous Waste Storage	–	7	72	0	3	–	–
76	Craft & Maintenance Shops	14	2,922	31,450	110	1	29	50
B-76A	Paint Storage	–	15	160	0	3	–	–
B-76B	Plumbing	–	15	160	0	1	8	–
B-76C	Maintenance Supplies	–	6	64	0	1	15	–
B-76D	Electrical	–	15	160	0	3	–	–
B-76E	Electrical	–	15	160	5	3	–	–
B-76F	Small Engine Shop	–	15	160	0	3	–	–
B-76G	Battery Storage	–	5	56	1	3	–	–
B-76H	Emergency Utility Storage	–	15	160	0	3	–	–
B-76J	Custodian Storage	12	15	160	0	3	–	–
B-76K	Craft and Maintenance	12	34	370	11	3	–	10
B-76L	Plant Engineering	10	134	1,440	6	3	16	10
77	Mechanical Fabrication Shops	13	6,575	70,775	91	2	30	50
77A	Ultra High Vacuum (UHV) Assembly Facility	13	1,008	10,854	8	1	5	50

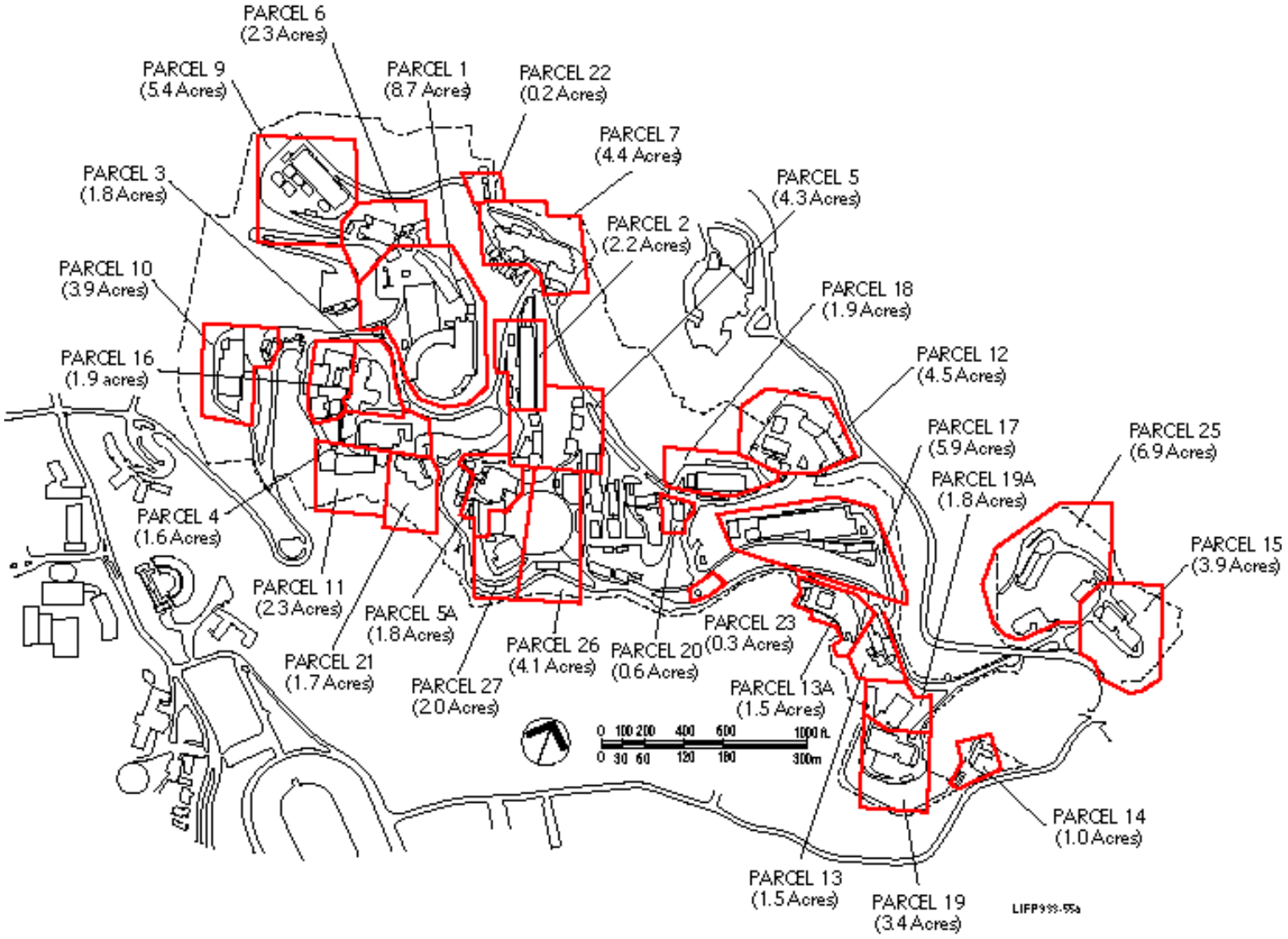
Building Number	Building Name Description	Functional Unit (c)	Area gsm	Area gsf	Persons	Condition/ Rehab Status (a)	Life Data	
							Age	Dsgn
B-77C	Welding Storage	–	2	23	0	1	–	–
B-77D	Drum Liquid Storage	–	10	108	0	1	–	–
B-77G	Mechanical Technology Department	10	66	710	4	3	17	10
B-77H	Auxiliary Plating Building	–	54	576	0	3	10	–
78	Craft Stores	12	501	5,392	2	1	27	50
79	Metal Stores	12	414	4,453	3	1	28	50
		Total(b)	**16,278**	**175,198**	**367**			
Area 6 — Materials and Chemistry Research Area								
62	Materials & Chemicals Sciences	15	5,134	55,265	65	2	28	50
B-62A	Office Trailer	10	111	1,192	5	3	15	10
B-62B	ICS Modular Building	–	16	173	0	3	–	–
66	Surface Science & Catalysis Laboratory (SSCL)	15	4,099	44,123	86	1	6	50
72	National Center for Electron Microscopy (NCEM)	15	493	5,308	10	1	32	50
72A	High Voltage Electron Microscope (HVEM)	15	235	2,532	0	1	3	50
72B	Atomic Resolution Microscope (ARM)	15	411	4,423	0	1	9	50
72C	ARM Support Laboratory	15	520	5,600	10	1	9	10
B-72D	Office Trailer	10	63	683	0	3	–	10
73	Atmospheric Aerosol Research	15	400	4,304	15	2	32	25
B-73A	Utility Building	–	37	403	0	1	32	–
B-74D	Storage	–	18	190	0	3	–	–
B-74E	Storage	–	86	927	0	3	–	–
		Total(b)	**11,623**	**125,123**	**191**			
Area 7 — Life Sciences Research Area								
B-33A	Strawberry Canyon Gatehouse	–	5	52	0	1	28	–
74	RMRB, Cell & Molecular Biology Lab.	15	4,214	45,359	120	2	31	50
74B	RMRB, Cell & Molecular Biology Lab. Annex	15	319	3,436	7	1	24	50
B-74C	Emergency Generator Building	–	17	180	0	1	–	–
83	Cell & Molecular Biology	15	650	6,995	11	1	14	50
B-83A	Laboratory Trailer	15	46	493	0	3	28	10
85*	Hazardous Waste Handling Facility	–	1,208	13,000	–	1	–	–
		Total(b)	**6,459**	**69,515**	**138**			
	Hill-Site Grand Total		***155,596***	***1,674,617***	***3,577***			

Building Number	Building Name Description	Functional Unit (c)	Area gsm	Area gsf	Persons	Condition/ Rehab Status (a)	Life Data	
							Age	Dsgn
Off-Site Leased Buildings								
901	Receiving/Warehouse, 1450 64th St., Emeryville	12	6,474	69,680	9	NA	NA	NA
901A	Warehouse/Excess Material, 1450 64th St., Emeryville	12	2,490	26,802	0	NA	NA	NA
934	DYMO Bldg: Print Plant, Cell & Mol. Biology, 91 Bolivar Dr., Berkeley	10	2,854	30,720	58	NA	NA	NA
936	Berkeley Ctr.: Accounting & Financial Mgmt, 2070 Allston Way, Berkeley	–	1,215	13,077	60	NA	NA	NA
940	Cholesterol Research Center, 3030 Telegraph Avenue, Berkeley	–	39	415	3	–	–	–
		Total(b)	**13,072**	**140,694**	**130**			
UCB Campus Building with assigned Berkeley Lab Numbers								
1	Donner Laboratory	15	2,354	25,334	135	–	–	–
3	Melvin Calvin Laboratory (includes Bldg. 3B and B3A on roof)	15	2,204	23,724	5	–	–	–
8	Hearst Mining	–	1,894	20,382	36	–	–	–
11	Hildebrand Hall	15	1,634	17,586	59	–	–	–
18	Gilman Hall	15	909	9,781	30	–	–	–
19	LeConte Hall	15	333	3,580	15	–	–	–
19A	Birge Hall	15	1,315	14,159	44	–	–	–
20	Life Sciences Building (LSB) - under construction							
20A	Life Sciences Building Addition	15	61	660	1	–	–	–
21	Low Temperature Laboratory—Giauque Hall	15	939	10,102	35	–	–	–
22	Latimer Hall	15	1,298	13,974	33	–	–	–
24	Etcheverry Hall	15	168	1,806	3	–	–	–
38	Lewis Hall	15	654	7,042	14	–	–	–
39	Cory Hall	15	47	511	2	–	–	–
57	Cowell Hospital—Donner Pavilion	15	243	2,614	13	–	–	–
905	Hesse Hall	15	547	5,887	5	–	–	–
921	Stanley Hall	15	168	1,804	5	–	–	–
925	Giannini Hall	–	–	–	–	–	–	–
926	Morgan Hall	–	–	–	–	–	–	–
928	Haviland Hall	–	–	–	–	–	–	–
952	Moses Hall	–	–	–	–	–	–	–
953	Earth Sciences	–	–	–	–	–	–	–
970	SCM Building – 6701 San Pablo Avenue, Berkeley	–	–	–	–	–	–	–
980	Animal Behavior Building	–	–	–	–	–	–	–
981	Experimental Thermal House – Walnut Creek	–	–	–	–	–	–	–

Building Number	Building Name Description	Functional Unit (c)	Area gsm	Area gsf	Persons	Condition/ Rehab Status (a)	Life Data	
							Age	Dsgn
982	Medical Research Laboratory	–	–	–	–	–	–	–
983	Wurster Hall	15	464	4,998	6	–	–	–
984	Davis Hall	15	84	906	2	NA	NA	NA
985	Garage	–	–	–	–	–	–	–
986	Harmon Gym	–	–	–	–	–	–	–
987	Warren Hall	15	39	423	2	–	–	–
988	Boalt Hall	–	–	–	–	–	–	–
989	Lawrence Hall of Science	–	–	–	–	–	–	–
990	Evans Hall	15	18	195	1	–	–	–
991	T-4 (Energy & Resources Program)	–	–	–	–	–	–	–
992	Tolman	–	–	–	–	–	–	–
993	T-9 (University-Wide Energy Research Group)	–	–	–	–	–	–	–
994	McLaughlin Hall	–	–	–	–	–	–	–
995	Barker Hall	15	168	1,806	3	–	–	–
996	Campbell Hall	–	–	–	–	–	–	–
997	Minor Hall	–	–	–	–	–	–	–
998	Silver Laboratory (Space Sciences Laboratory)	–	–	–	–	–	–	–
999	Mathematical Sciences Research Institute	–	–	–	–	–	–	–
		Total(b)	**15,541**	**167,274**	**449**			
Richmond Field Station								
911-177	Radon Research House	15	179	1,925	0	NA	NA	NA
911-180	Indoor Air Quality Laboratory	15	343	3,693	6	NA	NA	NA
911-198	Earth Sciences Laboratory	–	159	1,711	0	–	–	–
		Total(b)	**681**	**7,329**	**6**			

(a) Rehabilitation Status
1 = Adequate
2 = substandard, can be made adequate
3 = Substandard, cannot be made adequate
(c) Functional Unit
10 = Administrative
12 = Storage
13 = Production
14 = Service
15 = Research and Development
16 = Reactor and Accelerator
29 = Other
***Proposed new construction to begin FY**

APPENDIX D BERKELEY LAB LAND LEASES



BERKELEY LAB LAND LEASES

Parcel Number	Area (Acre)	Effective Date	Expiration Date
1	8.7	1949	1999
2	1.7	1948	1998
3	1.8	1948	1998
4	1.6	1953	2003
5	4.3	1950	2000
5A	1.8	1986	2036
6	2.3	1951	2001
7	4.4	1955	2005
9	5.4	1959	2009
10	3.9	1959	2009
11	2.3	1959	2009
12	4.5	1959	2009
13	1.5	1960	2010
13A	1.5	1985	2000
14	1.0	1960	2010
15	3.9	1961	2011
16	1.9	1960	2010
17	5.9	1962	2012
18	1.9	1962	2012
19	3.4	1962	2012
19A	1.8	1985	2035
20	0.6	1963	2013
21	1.7	1965	2015
22	0.2	1967	2017
23	0.3	1969	2019
25	6.9	1978	2028
26	4.1	1988	2037
27	2.0	1988	2037
998 (Occupancy Agreement)	3.6	1948	1993
999 (Contractor Controlled)	48.9	1948	1990

Total Acres	**134.7**	**134.7**

APPENDIX E ACRONYMS AND OTHER INITIALISMS

ABAG	Association of Bay Area Governments
AC	Alameda County
AECR	Advanced Electron Cyclotron Resonance
AGMEF	Ana G. Méndez Educational Foundation
ALS	Advanced Light Source
AML	Advanced Materials Laboratory
BARRNet	Bay Area Regional Research Network (Consortium)
BART	Bay Area Rapid Transit system
BES	basic energy sciences
BPA	Bonneville Power Administration
Cal-EPA	California Environmental Protection Agency
CAM	Center for Advanced Materials
CAMP	Capital Asset Management Process
CCF	Central Computing Facility
CDF	Collider Detector at Fermilab
CEQA	California Environmental Quality Act

CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CERN	European Council for Nuclear Research (Geneva)
CIEE	California Institute for Energy Efficiency
CRE	Conservation and Renewable Energy
CRT	cathode ray tube
DECnet	Digital Equipment Corporation's networking system
DOD	Department of Defense
DOE	U.S. Department of Energy
DOE/OAK	DOE Operations Office at Oakland
EBMUD	East Bay Municipal Utilities District
ECR	electron cyclotron resonance
EH&S	Environment, Health and Safety Division
EM	Environmental Management
EMCS	energy monitoring and control system
ERWM	Environmental Restoration and Waste Management
ES&H	Environment, Safety and Health (DOE)
ESnet	Energy sciences network (computer support for DOE energy research)
FTE	full-time equivalent position

FTS	Federal Telecommunications System
GPE	General Purpose Equipment
GPP	General Plant Projects
gsf	gross square feet
gsm	gross square meters
HILAC	Heavy Ion Linear Accelerator
HVAC	heating, ventilating, and air conditioning
ICS	Integrated Communications System
IHEM	In-House Energy Management
JSU	Jackson State University
Berkeley Lab	Ernest Orlando Lawrence Berkeley National Laboratory
LBLnet	Laboratory-wide computer network
LCP	Life Cycle Plan
LDC	less-developed country
LLNL	Lawrence Livermore National Laboratory
LRDP	Long Range Development Plan

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